# GAS JOURNAL

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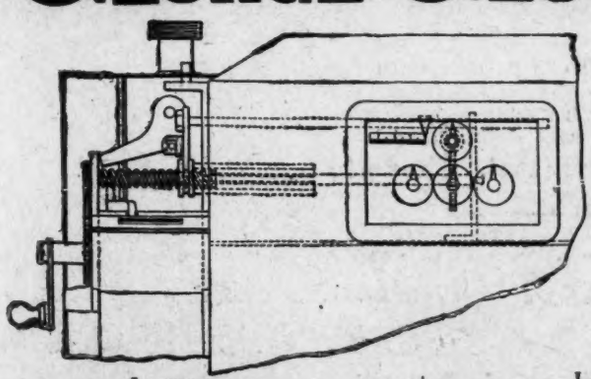

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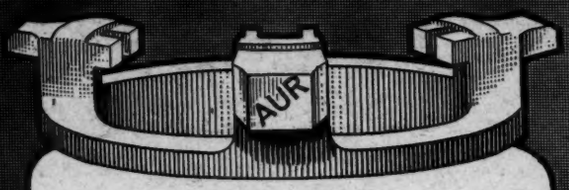


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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CXLVI., No. 2927.] TUESDAY, JUNE 17, 1919. [71ST YEAR.


## EDITORIAL NOTES.

### The New Rationing of Fuel and Lighting.

THE country can now see that it is wholly in the power of the miners; and every part of the community and the industries by which it lives are, as a result, to suffer shortage of coal production, high prices, and reduction of export trade. The worst feature of this is that there is not any occasion for it; if it were unavoidable, the country would bear it with all the equanimity it could command. It is a position created by the miners exclusively for their own ends, and is therefore something that is artificial; and artificial creations that interfere with the operation of economic laws must have disastrous consequences. If the current reduction of output was due to shortage of men through military service, it would have to be borne; but there is no such shortage. The mines have now had re-established the man power that was in them in 1913, in which year there was maximum production. What the miners did then, could, if they would only will it, be done now. Were they to do this, the country would not at the present time be undergoing rationing again for fuel and lighting, and having its inconveniences spread broadcast. Fortunately, it is not rationing to the acute extent that the late Sir Guy Calthrop imposed on the country; but nevertheless it is a limitation which need not (as was seen in our editorial columns last week) exist were it not for the miners' reluctance to do again what they have proved themselves capable of doing. The new Rationing Order has not yet been issued; but the terms in which it will be have been set out in an official statement that has been circulated, and is reproduced to-day in later columns. It is the best the Coal Controller (Sir Evan Jones, Bart.) can undertake to promise the country; and, even so, it is obvious that he is in a speculative position. He hopes that conditions will so far improve that there will be opportunities for relaxation. If there was any certainty in his mind that there would be an improvement in coal production of a really substantial order—bringing up output to (say) the level of 1913—there would be no pressing reason for re-rationing. This is the plain fact. Sir Evan has to legislate not for hoped-for eventualities, but for the output that shrewd calculation, in which the miners' mood and reduced working hours are factors, will permit him to reckon upon.

The new terms provide well for the relief of the small gas and electricity consumers by exemption from rationing of all who use less than 5 tons of coal in a year, 12,500 c.ft. of gas in any quarter, and 400 units of electricity in any quarter. These particular figures we take it will include lighting. If so, it makes worse the criticism which must be offered upon the equality of gas consumption in the summer and winter quarters, seeing that in the winter quarters consumers using gas for cooking, heating, and lighting will require much more than in quarters when gas is only used for cooking, water heating, and, owing to "daylight saving," very moderately for lighting purposes. If it is possible, the 12,500 c.ft. "in any quarter" should in the Order be altered to 50,000 c.ft. in the year, commencing on July 1. For householders using above the quarterly figures mentioned, the old assessments and equivalents—18,750 c.ft. of gas to the ton of coal, and 1000 units of electricity—stand. In view of the productive circumstances, the addition to the original equivalent of gas was, as was stated in our columns when first the concession was made, nothing but just; while the raising of the equivalent of electricity to 1000 units to the ton was an accentuation of the absurdity that marked all through the dealings of the late Coal Controller with electricity, when he himself was able to show that the average production of electricity per ton of coal is nearer 500 units, so that approximately 2 tons of coal have to be expended on the average in order to arrive at the equivalent of 1000 units. Gas consumers had better be advised to mark well the new conditions, and see precisely where they stand, so that there is not the chaos that existed in many cases not only before October last, but well up to the end of the year. Their attention should also be immediately directed to the fact that coke (as well as anthracite and patent fuel) will be exempt from the operation of the new Order; and so this summer season should see a complete clearance of all surplus coke from the yards of gas undertakings. In issuing the new Order, it is to be hoped Sir Evan Jones will make it as concise as possible, and not allow it to be so voluminous and loaded with verbiage to such a degree that it has been solemnly avowed in respect of the last one that nobody, save Mr. Frank Pick, who has charge of the rationing department of the Coal Controller's offices, ever became completely acquainted with its contents and meanings.

### Changes for the Gas Industry in Commercial Places and Values.

MUCH is heard in these times about the bright future that the gas industry has if released from the present financial and statutory bonds which circumscribe its movements. These are matters that have been frequently dealt with. But all that is hoped-for is not coming without effort by the men of the industry. They have one and all energetically to perform their part, and not sit in armchair comfort, waiting, Micawber-like, for something to turn up. There is no component in the operations of a gas undertaking that does not want investigating to see that it is being run in the most economical fashion, and is yielding its maximum. Economy on the one hand, and maximum over-all yield on the other, are necessary to help in the required rectification of obsessing difficulties. It has been seen that the gas-works in the Provinces that have been in the position to make the largest use of charge steaming and blue water gas have been able to weather the storm better than those that have had to rely solely on coal; and this has been a lesson of inestimable advantage to the industry. To these matters, Mr. Alexander Bishop, of Newton Grange, referred in his address at the meeting of the Waverley Association last week; and we agree with him that production is the direction in which the gas industry must look for a material part of the relief from the financial disadvantages from which it is suffering. Increased production in B.Th.U.'s from the coal used will in itself confer greater freedom in seeking an expansion of business.

Centralization of gas production, too, is advocated by Mr. Bishop with the view to economy, and the extension of supply to territory within the reasonable reach of high-pressure mains, with a gas that is now much more suitable for compression and transmission. The gas industry has within its grasp—and it is hoped it will not let it slip—the power (finance is the one deterrent) to make its way into hitherto fallow areas. A great deal has been said regarding super-stations for generating electricity, and the carrying of the energy to rural areas. But super-stations are losing adherents; and long-distance transmission, in order to secure a little business (and that probably unprofitable) is causing no slight hesitation in the minds of many electrical men whose enthusiasm formerly outran discretion and practical facts. In these respects, electrical ideas are coming somewhat nearer the places where the gas industry can deal with them on grounds of greater equality. The electricity gene-

rating centralization that numerous qualified men believe will come will be of a more local character than the original products of certain lively imaginations. For many areas, it is believed local generating plants will be preferable to, and cheaper than, long-distance transmission. The principles of coal conservation, too, include the treatment of bituminous coal, so as to obtain for the country a variety of products from it. Thus, step by step, if the Government will only listen to reason and be led by it, we are getting nearer the stage where gas undertakings can supply either coke or a coke-produced gas to electricity generating plants —so serving the ideals of coal conservation, the provision of larger markets for the gas industry, and putting into the possession of the electrical industry a fuel which will remove from it the stigma of prodigality so far as coal is concerned, even if it does not do anything to reduce the huge percentage of the total heat supplied which represents boiler loss, turbine loss, thermo-dynamic conversion of heat into work, and transmission loss.

A vast amount of consideration is being given to the gas side of the problem, as is essential; but this must not be to the disregard of the other products which are an integral part of the business, but are all too often consigned to a minor place, and there in many cases are more or less neglected or left to chance. They have likewise in every gas-works to be developed so as to yield their maximum. Quality, quantity, and the most promising markets, are the three directions in which close survey should be made, and supervision be given. Mr. Bishop in his allusions to coke refers to the fact that the demand for it has increased to abnormal proportions, owing to the high prices of coal. It is also gratifying to him to see the manner in which householders have been using the fuel for domestic purposes. Every effort should be made to retain the custom that has been obtained. These remarks raise certain reflections. In the future a larger proportion of the coke made by the industry will be required for gas production for dilution purposes; and, if the industry extends its operations in industrial areas (as it should do), a considerable amount of coke should be claimed for the production of industrial gas. In this connection, we must not allow to slide into the background the views of the Board of Fuel Research, that "for "some industrial purposes, water gas is an ideal gaseous "fuel," and that blue water gas "is one of the finest and "most manageable of fuel gases for industrial purposes, "which it would pay, in certain cases, to distribute over a "fairly wide area." And the Board recommend for gas supplied in bulk for industrial purposes some relaxation of their proposed stipulations. Where retort charges are being steamed, and more of the volatile matter is extracted from the coke, and high temperatures are employed, the coke becomes still further removed from those characteristics that make a good domestic fuel. It is therefore into the paths of industry that we shall have to drive our coke more and more, where high temperatures and steaming are practised. But this does not matter. The steam-boiler, with forced draught, is one of the proper destinations for such coke. Its greatly extended use for steam-raising is resulting in greater appreciation for the purpose in these times, because once the steam-boiler owner has tuned-up his furnaces to the burning of coke, he finds very little difference in its use no matter what the source of his supplies, which is not so with coal in these days. The ash content of coke, for equal weights, is greater than that of coal; but, as Mr. J. H. Coste, F.I.C., has pointed out, in other respects cokes from different sources are much more alike than the coals from which they are produced, as the differences in the coals (excepting in the variable ash content) are largely eliminated in the carbonizing process. But as to the ash, we are looking for cleaner coal when the coal industry settles down to proper work again, and seeks to remove the discontent that its crude operations during the war have so largely created in the country. Combined with the resulting improvement in the quality of the coke, gas engineers should see to it that, by draining or some other process, as well as sheltering, coke is supplied containing the minimum quantity of moisture.

Tar is also mentioned in the address; and the production of a richer tar is a change ensuing upon the alterations in carbonization practices. The industry should derive full benefit from this. The arrangement that the Scottish Gas Council and the tar distillers entered into should ensure a more equitable distribution of value than hitherto, as between producer and purchaser. A somewhat similar arrangement has also been effected this side of the Border; but in future more is going to be made out of tar by co-operation between producers and distillers and between gas undertakings themselves. There is in existence a very large scheme of co-operation between certain distillers and gas undertakings, under which (as we understand) tar and profits are pooled, the latter of which have an agreed proportionate allocation, which is beneficial to the works included in the scheme. The tar co-operation idea (which has long been advocated in the "Journal") is growing among gas men; and we feel confident that there will be important developments in this direction. Where co-operation cannot be effected in connection with tar, there are rumours of an alternative. A plant, it is stated, is coming that will enable all gas-works down to quite moderate sized ones to become distillers on their own account—the plant requiring little supervision, and being quite easy to manage. More than this cannot be said at the moment; and we must guard readers against putting their expectations too high in view of these remarks by saying that the plant is still in the experimental stage. Some inventions that are most promising when in the experimental stage have come to naught when they have passed over to the working stage.

Sulphate of ammonia is also mentioned by Mr. Bishop. He is of opinion that the enforced use of sulphate of ammonia by farmers during the war will have got them accustomed to it; and this in future will have a beneficial effect. The farmers have learned, too, that sulphate of ammonia contains more nitrogen value than nitrate of soda at their respective prices, and probably also that sulphate of ammonia has greater stability than nitrate of soda in wet seasons—that less nitrogen is lost to the land. There are other considerations. The steaming process has produced larger makes of sulphate per ton of coal carbonized; and this means much in the competition that is most surely coming. So, too, does the supply of a neutral sulphate with a good percentage of ammonia in it. Fresh methods of neutralizing sulphate have been developed during the war; and there will be no excuse for any maker, directly a neutralizing process can be applied, supplying an article which is not rendered perfectly innocuous so far as the acid content is concerned. The industry will also find before long that its sulphate export trade will not be in the same markets, or at any rate to the same extent, as in the days before the war. New markets at competitive rates will have to be found for any surplus production that cannot be placed at home. There is also the sulphur that is recovered in purification. Greater attention should be paid by all works to the realizing of the highest possible value for this.

In these and other directions, the gas industry has to look for its economies and enhanced business under the wartime converted conditions. The changes that are coming over gas manufacture are, as we have seen, bringing in their train new conditions for the secondary products; and these conditions, bearing upon quality, quantity, and marketing, require very close study in order that the path may not be missed to the making of the greatest stability as well as the largest profit.

## Limited Central Control of the Coal Industry.

The inquiry by the Coal Commission into the question of the nationalization of the coal industry is drawing to an end. It is not an enviable subject upon which there is to be adjudication; for, as in the case of the first report, there is not likely to be unanimity, and no one section of the parties concerned—owners, miners, and (the last thought of) consumers—will in the result be altogether satisfied. Though the Commissioners are expected to give a judicial verdict upon their investigation, there may be some confidence that, from certain quarters of the tribunal, there will not come an impartial verdict, and therefore not a judicial one. Some cherished tenets are difficult to disestablish; and even if from the mass of contradiction, irrelevancy, stage play, sober truth and fact, and wise deduction, the holders of these tenets saw their serious defects, we are afraid they would not admit their own previous misconception and misleading. No unbiassed observer and follower of the proceedings can, from the reports available, have come to any other conclusion than that the case for nationalization has not been proved, but that the case for limited control has been. But, if limited control is imposed, there must be great care as to its form and terms. It must not be of the old bureaucratic order; and it must not be of a form in which the miners will have a share that can be employed

to overwhelm other interests, for their line of action since the armistice in the matter of coal output (some award partial blame to the insufficiency of tubs at the collieries), and the trouble and expense they have imposed on the country, have shown their irresponsibility towards, and their utter disregard for, national interests. Men who can behave thus are altogether ineligible for participation in the control of a business of the very first importance to the nation.

We hope with Mr. D. Milne Watson, the President of the National Gas Council—a *précis* of whose evidence before the Commission was published last week—that nationalization will not be proposed by the investigators, and that whatever control is recommended will be of a limited character. But we are not sure that it should be limited too closely to what Mr. Milne Watson recommended—"efficient "control with regard to profits, wages, housing, &c.," though that is consistent with a recommendation by Sir Richard Redmayne, that prices should be regulated by a central authority representative of the coal owners, the miners, and the Government—the last-named apparently representing the consumers, which representation would be inadequate. The extent and nature of the control should be largely governed by the composition of the controlling body. If it is to be a Government Department, the control should be limited to profits and wages; but if it is a body not dominated by a Government Department, then the gas industry has, through Mr. Milne Watson and Mr. A. E. Broadberry (a summary of whose evidence was also published last week), proved a case for further control, and at the same time the insufficiency during the war period of the control of a Government Department. The gas industry wants to see the coal distribution control removed, which has proved, so far as the industry is concerned, such a fearful failure, imposing increased costs on the grand scale, and in no small part for material that has fallen far short of the standards of suitability for gas-making. Complaint of this has reached us from all over the country. And every effort has been made by gas undertakings and the National Gas Council to impress the official mind with the fact that ton-miles are not saved if more material has to be purchased owing to the unsuitability of that delivered for gas making, and that further ton-miles are wasted by the conveyance of excess inert material from the pits to the places of use in defiance of national economy. There we have control on the one hand and the want of control on the other from one Government Department, both of which have been repugnant to one of the main objects of control—maximum national economy under the prevailing conditions. On the one hand, there has been absence of intelligent dealing with the situation; on the other hand, there has been no exercise of the sovereign power the State is supposed to possess. The gas industry has had to pay very dearly for this—to a greater extent than any other industry—not only for the reason that it is perhaps the second largest user of coal in the country, but because, coal being its principal raw material, quality (in relation to price) is of great importance, and deficiencies in quality have to be compensated for in some way.

State control has not during the war given to the gas industry what it requires in the way of quality (to say nothing of quantity). Therefore—the same thing applying to other consumers—some different form of control would appear to be necessary, which will in some way be able to connect-up price with quality. It seems to us that whatever form of control is set up, accompanying any regulation of price should be a sliding-scale based on quality in respect of ash and dross, and perhaps other considerations. Quality, as expressed even in terms of the percentage of ash, could not, of course, be standardized. It would be incomparably worse than the old universal standardization of the quality of gas by Parliament, which failed to appreciate that such gas standardization was based upon conditions which it was impossible to standardize—the quality of coal and the circumstances of its carbonization, for example—and therefore it was a foolish thing to do. But in the case of coal, if excessive ash meant a loss of value at the pit-head, means would quickly be taken to wash and otherwise clean the coal in better manner than has been the case during the war. There is no excuse now for dirty coal any more than there is for the shortage of supplies. Therefore control—if the body be of the right quality and composition and invested with the proper authority—should cover, to the extent indicated in this article, a somewhat larger territory than profits, wages, and housing. But the case for nationalization has certainly not been proved.

## Liberty for Sulphate of Ammonia.

A letter appears to-day in our "Correspondence" columns from Dr. Charles Carpenter, the Chairman of the South Metropolitan Company, in which he deals with the control price of sulphate of ammonia and the export of the surplus. The question and answer in the House of Commons to which reference is made in the letter were reported by us last week [p. 703]. The organization for the centralizing of sales was fully explained in our issue for March 25 [p. 647]; and it has been understood that practically the whole of the sulphate of ammonia makers are participating in the combination. Regarding Dr. Carpenter's remark that "the Board of Agriculture refuses to issue a licence to us," in his statement to the House the Parliamentary Secretary to the Board said: "The Board had written to the Company expressing their willingness that export licences should be granted to them on the same terms as to the rest of the makers; but it would not be in the public interest to make exceptional arrangements in their case." As opposed to this, it is understood that the Board of Agriculture have agreed that licences should only be issued in respect of applications made by the Central Committee representing the producers. On their face, there appears to be a variance between these statements; perhaps there is some explanation beneath them. There is thorough agreement with Dr. Carpenter that "we want to get as many as possible of the vexatious controls which hamper industry in all directions removed, instead of bolstering them up." Upon the word "vexatious" different degrees of meaning can be put according to circumstances; and there are some "circumstances" which justify certain steps that would preferably not be taken if the "circumstances" were of a more favourable order. It is all a question of the best policy under prevailing and prospective conditions; and there is no doubt as to the views of the majority of the makers in this particular instance.

## Competition for Sulphate Export.

A point which must be remembered is that sulphate of ammonia makers are approaching a crisis so far as the export trade is concerned. There has to be met the increased production of artificial fertilizers the world over. It is not only the extraction of nitrogen from the atmosphere, the production of cyanamide or nitrolim, and the augmented energy that the nitrate of soda producers must put into their trading enterprise that is hemming us round with competition, but the fact that in all countries where carbonization of coal goes on there the production of ammonia is steadily on the increase—particularly from the coke-oven industries. Take America, for instance. That country now, instead of being buyers, wants a considerable outlet for its production. The combine controlling all but a fraction of the output may have anything between 250,000 and 300,000 tons for disposal by export during the coming twelve months. America's nearest market is Java; and Java has hitherto been a large buyer of British produce. Another point which should be noted is that American producers are selling two grades of sulphate of ammonia, of high quality—"ordinary," 25 p.ct. ammonia minimum; and "special" (specially neutralized, dried, and ground), guaranteed to contain 25¼ p.ct. ammonia. Java always buys on a 25 p.ct. basis. It is obvious from what is going on in other countries that this one cannot do without a representative trading organization for sulphate of ammonia, and one authorized by its membership to take whatever action is good for the trade generally. It is also manifest that makers in this country must not be behind others in ammonia percentage, neutrality, and moisture content. What was good enough at one time is not good enough to-day.

## Co-Operative Housing.

The letter on "Co-Operative Housing" which comes from Mr. Arthur Silverthorne, and is published in our "Correspondence" columns to-day, suggests that he is not in very close touch with what is going on in the commercial spheres of the gas industry. The organization that is "supposed" to advocate gas interests in connection with new housing schemes are very much alive with their propaganda work—in fact, they are at the present time largely concentrating upon it. But, of course, it is not likely that, with all the acumen of the leaders in this organization—the British Commercial Gas Association—they will meet with success at every turn. The Lincoln scheme to which Mr. Silverthorne directs attention is that of a private firm; and where

a private firm has a large quantity of "waste" heat and steam at hand, it is quite natural they should put it to what they consider the most profitable use. The conditions are exceptional; and it is not a question of ordinary competition between gas and electricity. Here we have, through availability of waste heat and steam, the fundamentals for, it might be expected, cheap central heating (from which we personally hope always to be free) and electricity generation. Then we do not think many local authorities interested in housing schemes will be prepared to spend £65 on hot-water and electricity services for each small house. The set-off by savings in building and equipment of the old-fashioned order for coal heating can be realized equally as well by gas, and is a point that has been made in its extensive propaganda. According to the statement of our correspondent, that the central station and the supply mains in the Lincoln scheme are estimated to cost an additional £250,000 for the 3000 houses, the services (if they are to be self-supporting) are going to cost the tenants of the houses something. To-day 10 p.ct. is not an adequate allowance for capital charges, maintenance, depreciation, and so forth; but even 10 p.ct. would mean a substantial sum per house.

### Lower Calorific Value Gases.

The conditions of the gas industry before the great world upheaval bear no resemblance to those existing in the industry to-day; and gas use to-day and the prevailing economic conditions invite the industry to transfer more of the thermal value of gas into its distributing mains for sale, and even to purchase what Mr. Silverthorne calls "waste gases" from coking plants. We cannot regard as "waste" gases having a calorific value between 400 and 500 B.Th.U.—more especially in these days when the incandescent burner has made it unnecessary to use gas for its luminosity. It is strange that Mr. Silverthorne should have referred to low-grade gas being discarded for power, because all over the country the manufacturers are asking for lower grade gas for their purposes, so long as they can get it at a lower price. As a matter of fact, when dealing with coal gas for motive power, the higher the calorific value the lower is the compression with which the engine can work; and that high authority on gas-engines, Sir Dugald Clerk, F.R.S., not long since stated: "I am very pleased indeed from the gas-engine standpoint to see that the calorific value of the gas is coming down, because it makes it much easier for us." In regard to other pertinent matters, the reports of the Gas Investigation Committee, which have been before the last two meetings of the Institution, should enable Mr. Silverthorne to adjust his ideas to contemporary requirements and usage.

### Housing Schemes and Electrical Effort.

The electrical folk are deploring their bad luck in connection with the housing schemes. Installation costs have gone up tremendously—more so than in the case of gas. Before the war, electric wiring and equipment cost much more than gas piping and equipment; and suppose in both cases costs had only doubled, this would have caused the difference between the two to become more marked. Besides, if it was absurd to suggest prior to the war the use in the working man's home of electricity for cooking and heating, it would be an insane thing to do now, with the charges very generally ruling. It will be seen from our "Electric Supply Memoranda" that there has been a conference on the subject between the Institution of Electrical Engineers and other organizations to ascertain whether a way can be found to escape from the impasse in which the industry finds itself in this particular matter. It would be better to leave well alone, and not do irretrievable mischief by trying to place electricity where the householders' means only make more acute the fact of unsuitability. But the electrical people are going to bring to bear—responsible gas men had better note this—all the influence they can upon those local authorities who own electricity stations to force prospective tenants of these houses to use electricity by only equipping them with it. It will not, however, be long before the tenants would find that they have unwillingly made acquaintance with the road to ruin; and then great would be the outcry. In certain places, too, consideration is being given to the complete equipment of sample houses with electrical appliances. We hope that the whole costs of running at current rates will be given, and so not secure patrons from the working classes under false pretences. Some useful information upon gas equipment in relation to housing schemes is embodied in a paper by Mr. A. Masterton, which is published in subsequent columns this week. We are afraid, from what is heard, that sufficient has not been made by gas salesmen of the superior quality of gas lighting compared with electric lighting. Seeing that the preservation of human vision is of greater importance than the convenience of lighting-up and extinguishing electric lamps, the quality of gas light should be made a strong point in prosecuting this line of business. As to other matters bearing upon the housing problem, the paper claims careful consideration.

## PERSONAL.

The Gas Committee of the Glasgow Corporation recommend that Mr. Alexander Wilson, who is retiring owing to the state of his health from the position of General Manager and Engineer of the Gas Department, shall receive a retiring allowance of £750 per annum. His services are to be available in a consultative capacity.

Last Tuesday, Mr. Peter B. Watson tendered his resignation of the office of Engineer and Manager of the Wishaw (N.B.) Gas-Works, after sixteen years' service. Mr. Watson, it will be remembered, has for some years been Hon. Secretary of the North British Association of Gas Managers.

Mr. H. Matterface, who has taken up the position of Manager of the Monmouth Gas and Water Works, has been presented by the traders of Cinderford and friends with a gold watch, to mark their appreciation of his twelve years' service as Manager of the Cinderford Gas Company. There was also a pair of silver salt-cellars for Mrs. Matterface. Various speakers expressed appreciation of Mr. Matterface's services; it being pointed out that during the time of his control at Cinderford the output of gas was more than doubled. The Directors of the Gas Company subscribed handsomely towards the gift.

In succession to Mr. William Bennett, who has secured the position of Engineer and Manager of the Mossley Corporation Gas-Works, Mr. J. H. Ranft, of Lancaster, has been appointed Gas Manager to the Lytham Urban District Council.

Mr. John W. Halstead, who has been Superintendent of the Walsall Gas-Works since 1910, has been appointed Superintendent of the Sheffield Gas Company's Neepsend works.

At a meeting of the Stafford Town Council last week, the salary of the Gas Engineer, Mr. W. M. Valon, was increased from £650 to £800 a year—£50 being war allowance.

Mr. E. W. Browning, late of the Gas Light and Coke Company, Westminster, recently met with an unfortunate accident, and broke one of his ribs. His many friends will, however, be glad to learn that he is making a good recovery.

Lieut. Norman Stewart Dougall, of the R.A.F., son of Mr. J. S. Dougall, the Manager of the Boston Gas-Works, has been awarded the Distinguished Flying Cross.

## OBITUARY.

We regret to announce that Mr. Alexander Neil, who was for many years Chairman of Messrs. Fletcher, Russell & Co., Ltd., died at his residence at Colwyn Bay last Friday morning, in his eightieth year, after a short illness. Mr. Neil was one of the founders of the Warrington firm, and was well known in the gas profession.

Great sympathy will be felt with Mr. E. J. Brockway, J.P., of Cleethorpes, and his family, on the tragic death of his son, Mr. George Edwin Brockway, while testing a motor cycle. The deceased had not yet attained his twentieth year. It is thought that he was seized with a fit, and the heavy machine overbalanced. He was found unconscious, with a broken leg and fractured skull, and remained unconscious until his death, which occurred shortly afterwards in the Lincoln County Hospital. Mr. Brockway, who was a Cadet in the Royal Air Force, was on the point of getting his wings when the armistice put an end to his training, and he resumed his apprenticeship at the engineering works of Messrs. Ruston and Proctor, of Lincoln.

The death of Mr. Thomas Whimster, son of Mr. James Whimster, of Armagh, was the subject of an inquest last Saturday week, he having been found that morning drowned at the Folly Baths, Armagh. For about four years (until January last) he had been Engineer of the Armagh Gas Company, of which his father, who lately retired after 36 years' service, was the Manager and Secretary. Since then, it was stated, he had not been employed. The Jury returned an open verdict. The case was altogether a very sad one. Deceased's wife died a short time ago after childbirth; and the little one was buried just before Mr. Whimster's body was found. The body of Mr. Whimster was laid beside that of his wife in the Presbyterian Church Cemetery; the funeral being largely attended. Mr. J. K. Harrison (Armagh), Mr. James Woods (Monaghan), and Mr. George Airth (Dundalk) represented the Irish Association of Gas Managers.

## FUEL AND LIGHT RATIONING.

**Board of Trade Announcement.**

THE Controller of Coal Mines regrets to announce that it is found necessary to continue the rationing of coal, gas, and electricity for household fuel and lighting for a further period. It is, however, proposed to modify the present Order to the extent that consumers of less than

5 tons of coal in the year
12,500 c.ft. of gas in any quarter
400 units of electricity in any quarter

will not be subject to assessment. They must, however, be registered with their coal merchants for the supply of coal.

A revised Order which will take effect from July 1 next will be issued during the present month. In the meantime, the following memorandum is issued for the information of the public:

(1) Anthracite, coke, and patent fuel will be exempted from the Order for the time being.
(2) All consumers of coal must register with coal merchants for their supplies. Present registrations will be valid unless notice to the contrary is given by either consumer or merchant.
(3) The present assessments are current for a year from various dates, commencing with Oct. 1, 1918. In the case of consumers over the quantities named above, the assessments will be renewed for the same annual quantity for twelve months from July 1, and the balance of the old assessments cancelled.
(4) New certificates will be issued to all present holders of certificates for the twelve months' supply; and it will not be necessary to make application for the certificates, except in the case of new consumers or of those who, owing to a change in the basis upon which the original assessment was made, desire a modified assessment.
(5) The new assessments and certificates will date from July 1, in order to enable private consumers, so far as coal may be available, to stock on account of the coming year's allowances. Immediately on the issue of the new Order, arrangements will be made to enable this to be done during the months of July, August, and September.
(6) The supply of fuel already made under any existing certificates in respect of the period subsequent to June 30 will be treated as a supply on account of the new year's allowances.
(7) The conversion equivalents of gas and electricity in terms of coal will be fixed at—
18,750 c.ft. of gas to the ton of coal.
1000 units of electricity to the ton of coal.
(8) The control of maximum prices for the sale of coal will be rigidly enforced.
(9) In order to simplify some of the machinery and provisions of the present Order, the Special Local Fuel and Lighting Committees will be discontinued; and, in the ordinary course, the control of the Local Fuel Overseer will, subject to the directions of the Controller, be left to the local authority—except in the Metropolitan Division, which will continue under the immediate supervision of the Household Fuel and Lighting Branch of the Coal Mines Department.

Economy in the consumption of coal still remains vital to the national interests. If the output of coal in the near future will allow a relaxation of these restrictions, the Local Fuel Overseer will be authorized from time to time to receive applications for such increased allowances as any increase in the supplies of coal may justify.

## ELECTRICITY SUPPLY MEMORANDA.

THERE are now a great number of business men in the House of Commons, some of whom have been keenly solicitous as to the exact intentions of the Government in the matter of financing the electrical schemes. Business men know that, where trading is concerned, it is a violation of fundamental economic laws to fall back upon the taxpayers for support. It is notorious that the local authority part of the electricity industry does not experience any disturbance of conscience over the question of whether or not it is economically wrong, or the action financially unsound, to dip into the ratepayers' purse to make good the deficiencies caused by financial mismanagement. It has been one of the dear hopes of a section of the industry that the Government should make it a considerable present of funds to help in its reorganization; and it is no doubt due to the representations that have been made to the Government that it has been thought well to allay all apprehension on the point, and so avoid opposition. The Government has issued a memorandum on the subject, in which it is declared that it has no intention to permit the electricity industry to dip into the country's pockets without not only replacing what is taken out, but something beyond for the use of the money. And it looks as though, in several ways, a considerable amount of money will be needed. There are the expenses of the Electricity Commissioners. The whole of the administrative costs are to be ultimately borne by the District Boards, among whom they will be shared proportionately. Any money that may be provided by Parliament during the first five years to meet expenses is to be repaid with interest. It is computed—there is no certainty about it—that the expenditure on salaries, office, and travelling expenses of the Commissioners, their inspectors, assistants, and staffs, should not exceed £35,000 per annum. Then the Commissioners may undertake necessary experiments for the improvement of the methods of electricity supply; and it is thought—only thought!—that the expenditure on this account will not exceed £10,000 a year. This money is also be recovered from the industry, so that there will be no permanent charge on the State. The £20,000,000 to be spent on urgent works is also to be repaid with interest. Though under the Bill the Treasury are to be empowered to guarantee the interest on stock not exceeding £25,000,000, to be issued by the Commissioners as loans to the District Boards, the memorandum says it is impossible to decide in what cases (if any) it will be necessary to call upon the guarantee. But the Government wants it to be clearly understood that the whole scheme is based on the anticipation that the industry shall be self-supporting. When the District Boards charge a sufficient price for energy to the distributors to cover all outgoings and obligations, there will be no excuse for any local authority distributor having to look to the ratepayers to help to maintain the concern. It can all be run on a business-like footing; and this will be an improvement—in fact, a clause should be put into the Bill to ensure that income balances outgoings.

**Government Purse to be Repaid with Interest.**

**Difficult Conditions.**

The British Chambers of Commerce ought to be very much interested in the Government plans for "cheapening" the production of electricity, which plans may turn out in these times to be ideal ones for making it more expensive. However, after hearing Mr. Phillip Dawson upon the results of his study of the position, the Council of the Association of British Chambers of Commerce cannot entertain two opinions as to the Government having sadly miscalculated prospects through relying upon very shallow and not altogether impartial evidence. There is, he says, grave danger of the public being misled as to the cost of electricity from the stations that are a feature of the scheme. This has been recognized for a long time past. Mr. Dawson drew out one by one the factors that have to be considered in connection with the cost of electricity supply. Capital, running costs, influence of loads, and so on, were all marshalled. With a really good tramway, railway, power, lighting, heating, and cooking load, a load factor of 50 p.ct. might be obtained, while purely private lighting loads will only give a 15 p.ct. load factor. The 50 p.ct. would be the result of a superb combination of custom for which the mouth of every electrical engineer waters; for its realization would be the means of overcoming many a difficulty. Under the generating pooling system, however, the maximum load factor which some important industrial areas could get if allowed to preserve their independence will be pulled down by the purely residential areas and the intensely rural ones to which the blessings of an electricity supply have been promised. Then the water-supply problem is very important and difficult. For every 1 lb. of coal burned under the boiler, 50 gallons of water are required; so that for a large station using 1000 tons of coal a day, circulating water to the amount of about 5 million gallons per hour would be needed. It is only with the most modern practice of high steam pressures and high super heat, good vacuum, and a load factor of 50 p.ct., that it is possible to attain an overall efficiency in the neighbourhood of 18 p.ct., corresponding to 1¼ to 2 lbs. of coal per KW.-hour sent out of the station. Then with present prices, there is no hope of completing a large station, including buildings, coal storage, and plant much under £30 per KW. rated capacity, and for transmission mains there would have to be allowed something like £16 per KW. of plant installed. Mr. Dawson does not hide his opinion that too much has been made of the super-station as a remedy for all evils, and that the results of such stations have been heavily inflated. Yet the credulous politicians, though they have been warned from many quarters, steadily pursue their way into these to them unknown regions.

**Lessons from the Past.**

Applying the test of past experience, Mr. Dawson finds that large generating stations have taken from fifteen to twenty years to become fully loaded; and their entire plant has been scrapped or superseded during this period. Cables that have been laid to develop districts have continued to repose unused for years. So far as the average prospective consumer is concerned, the great increase in the cost of wiring, due to after-war conditions, is likely to act as a deterrent to his adopting electricity for domestic purposes. It is impossible to get the public to arrange to take a supply of electricity until it is at their doors; and this entails capital expenditure lying idle in districts where electricity has not hitherto been available. Owing to the many improvements in the industry, there is every possibility of the present-day plan being out of date ten years hence. Why, therefore, can we say to-day that things are at finality? Furthermore, the fact seems to have been overlooked that, where loads are distant from each other, it might be more economical to use two or more stations rather than incur the great cost of mains for transmission and distribution. Altogether, Mr. Dawson cannot see that any case has been made out for the State taking over electricity generation, any more than for it taking over the gas industry. And here we have only skimmed part of the address he delivered.

**How to Develop Business.**

The electricity supply industry is trying to gird-up its loins for the expansion of business; but it fully recognizes its difficulties, though not so frank about them as it might be. There has been a joint meeting of the Institution of Electrical Engineers, the Electrical Contractors' Association, and the Association of Supervising Electricians, to discuss the electrical equipment of small houses. This is where the difficulty is most acute, because with people living in small houses, cost usually counts; while with people occupying large houses, if they are really wealthy, cost does not matter so much with them, providing they get what they want. But people who are not wealthy are in the majority; and therefore electricity purveyors want to find out the best way to get their custom. They are relying greatly upon the "educative" work of the Electrical Development Association. But all the work of this body, however good it is, will not fatten the purses of the people, while the use of electricity for all purposes will lighten them. Mr. W. Cross, of Leicester, opened the discussion; and it was gathered from him that, for a nine to ten roomed house, the average consumption for lighting would be about 300 units per annum, which at 8d. per unit would mean £10 per annum, or at 6d. £7 10s. Radiators, he says, are useful for short-hour use; but there are not many people who can afford dual systems of heating for short and long hour use. Electric cooking was naturally favoured by the electricians as being very valuable; but what is comprised in electric cooking? If the small householder makes a change, he will want from the one appliance as great a range of service as the gas-stove gives him, at no more cost, and with as prompt response and reliability. Water heating was described as being somewhat difficult for electricity under present tariffs; so it is under any other tariffs. In these days, the householder requires to obtain any quantity of hot water rapidly, and not have to wait about for it. Where there are large families, it is very inconvenient to have to make a schedule of times at which different members can have warm baths. One speaker suggested a coal fire for water heating, and another meticulously ventured to propose a coke-boiler. It is quite evident there is to be nothing left for the gas industry in the domestic line—if the electricians have their way, which they are not likely to get. And their difficulties are not going to be lessened by the developments in the gas industry.

**The Blockade by First Costs.**

The discussion turned mostly on wiring. It is admitted that it is quite useless to talk about steel conduits and wooden casing for small houses; and so the small householder is expected to be satisfied with surface wiring, supported by cleats. There was the old advocacy, too, of blocks of houses being supplied from one service—presumably on the speculative plan of a definite charge, risking the quantity of current used. But electricians know perfectly well it is foolish to talk in this manner. The lighting consumption alone of small houses will not pay them, in view of the cost of installation. Lighting alone in small houses would hardly pay the gas people, with their cheaper installation costs. And it would not do for the electricity suppliers to put in costly radiators and cookers with lower priced units on the terms of a fixed price. That would be the road to ruin. Mr. W. R. Rawlings, who is an electrical contractor of high standing, spoke plainly. He stated that to-day the cost of installation in a house is about equal to eight years' electricity accounts. The cost of services, meters, &c., for a house with a consumption bringing in a revenue of 9d. per week averages about £20! Mr. Pinkney declared that the cost of services was now about 240 p.ct. above pre-war costs; and Mr. Milne, estimating on the plans of a model dwelling, asserted that the installation price came to £12 16s. 9d., but with cleated work to £6 19s. This, we take it, is for lighting only, and includes no fittings or other appliances. Therefore, if the small householder is anxious to have electricity, he must be content with what his fellows who are better off are not content with—cleated surface wiring. But, of course, those who are better off have to pay dearly nowadays. One speaker mentioned a tender that he had received for an electrical equipment in a small London flat. It amounted to £120! Regarding housing schemes, there were recommendations during the discussion that local authorities who are the local electricity suppliers should furnish the installation as well as the current, and that all local authorities and builders should put in the wiring—presumably excluding gas-pipes—at the time the houses are erected. The prospective tenants may see very good reason for this not being done. It would be far from the first time that houses wired when erected have subsequently, on the demand of the tenants, had to be furnished with a gas supply.

**The Mobilization of Electrical Associations.**

The electrical industry just started its Electrical Development Association, when Mr. C. H. Wordingham—who has been occupying the presidential chair of the Institution of Electrical Engineers—comes out with an ambitious scheme upon which there has not yet been time for those who are more immediately concerned to arrive at a definite decision. In his opinion, the industry has outgrown the Institution. So he wants to see that body clothed with a Royal Charter, and to be known as the Royal Institution of British Electrical Engineers. Of course, he fully recognizes that a sparkling diadem does not alone add to efficiency or expand service; and his scheme therefore proposes a reconstruction in manner that power and efficiency will permeate the whole fabric of electrical organization. Some of the elders of the Institution would prefer that it should remain a purely engineering body; but the majority of the members would like to see a commercial side developed. So Mr. Wordingham's plan is to have the Institution a chartered body, and for it to act as a sort of umbrella for all the Associations in the industry, which will notwithstanding maintain their individuality. He therefore suggests the formation of a Grand Council composed of representatives of all the councils of the associated organizations. Then there could be regular meetings of the whole of the Associations under the auspices of the Grand Council for the discussion in all their bearings of matters generally affecting the industry. Thus there would be one voice to answer them. In these circumstances, we do not think that the use of the term "Engineers" in the title is altogether appropriate. The "Royal Electrical Institution" would be better. But would the Grand Council really represent electrical interests as a whole? Would it include representatives of boards of directors of electric supply undertakings? Also the capital investment in the industry, which is its real foundation? We ask these questions as a result of the experience of the gas industry with the National Gas Council. When it was originally formed, it was constituted of representatives of existing organizations in the gas industry; but it was found that it suffered from the want of any authority that could pledge the administrators of gas undertakings, who after all are the men who are responsible. A reconstruction has taken place. The United Kingdom was mapped-out into areas; and the gas undertakings in each area elected their own representatives to act on the Council, and these representatives receive their instructions from the District Gas Councils. This has made all the difference. We commend the point to the notice of Mr. Wordingham.

## Distillation of Peat.

The "Journal des Usines à Gaz" for June 5 gives some interesting results obtained from the distillation of peat in vertical retorts of the Guardabassi and Gouillard type. The source of the information is not stated. With different kinds of peat, there were produced per ton 10,400 to 11,850 c.ft. of 400 B.Th.U. gas (after lime purification); 8 to 9 cwt. of coke of about 10,900 B.Th.U. (density ·353, attaining 1·5 to 2 in briquette form); and 1·6 cwt. of tar products. In addition, 1·6 cwt. of sulphate of ammonia and a small quantity of acetic acid can be worked-up. An analysis of the gases obtained shows a carbon dioxide content varying from 4·6 to 25·8 p.ct., carbon monoxide 15·7 to 20·8 p.ct., hydrogen 41·9 to 46 8 p.ct., and methane 7·2 to 10·5 p.ct. The article concludes with a description of the retort system by which these results were obtained.

## Chlorination of Benzene.

At a recent meeting of the Birmingham and Midland Section of the Society of Chemical Industry a paper on this subject was read by Mr. S. Raymond Carter. The method he describes is similar in principle to that employed by Dr. Colman for the determination of toluene in commercial toluol. It consists in distilling from an Engler flask 100 cc. of the sample at the rate of 7 cc. per minute, and interrupting the distillation at 122° C. and at 142° C. From the amounts distilled below 122° and above 142° the percentages of benzene and chlorobenzene are obtained from a graph; and the dichlorobenzene may be found by difference. Experiments with mixtures of known composition have shown that the percentages of benzene and chlorobenzene deduced from the graph are not affected by the other products which are likely to be formed during the chlorination of benzene. The method is an expeditious one—a distillation being complete in half to three-quarters of an hour; and it proves eminently suitable for investigating the products obtained from the chlorination of benzene either on the experimental or the industrial scale.

**Temporary Increase of Charges Act.**—The Local Government Board have made an Order under the Statutory Undertakings (Temporary Increase of Charges) Act, in favour of the Horsham Rural District Council and the Overseers of Billingshurst, permitting a maximum charge for gas in the area taken over from the North Sussex Gas and Water Company of 6s. per 1000 c.ft. The Board have received an application for an Order from the Gainsborough Corporation.

**Wales and Monmouthshire District Institution.**—As there was no opportunity (owing to the afternoon conference of the British Commercial Gas Association) of arranging a visit to the Grangetown Gas-Works on the occasion of last month's meeting in Cardiff of the Wales and Monmouthshire District Institution of Gas Engineers and Managers, it was decided that there should be a special meeting for the purpose a little later on. This has now been fixed for Thursday of this week. Prior to the inspection, there will be a business meeting at the works (at 2.30), when the matters which were down on the programme for the last meeting, but which there was no time to adequately discuss, will be considered. Tea will be provided by the Chairman and Directors of the Cardiff Gas Light and Coke Company.

## THE EDUCATION OF A GAS ENGINEER.

DURING the recent meeting of the Institution of Gas Engineers, the President (Mr. Samuel Glover), referring to the discussion which had been opened by Prof. Smithells on the subject of education, said there were several very interesting communications that might be received; and doubtless readers have been hoping to see them in print. We are glad now to be able to meet this wish by reproducing the following communications from the two gentlemen specially mentioned by him.

Mr. RONALD B. GLOVER (Manchester) writes: The paper read by Prof. Smithells before the Institution of Gas Engineers, and the discussion resulting therefrom, are of very considerable interest to all young gas engineers. As one who was privileged to be present at the annual meeting, yet not feeling free to enter into the discussion, may I now be permitted a short addition to the reported "Transactions"?

I suggest, in the first instance, that it will be always difficult to lay down a definite programme of training for the education of the future gas engineer. There are distinctly two types of young men who must be considered—namely, those whose fathers are in a position to include a University career in the training of their sons and those who cannot. The latter, I believe, are greatly in the majority.

In considering the University man first, I cannot follow a better lead than that of Mr. Harry E. Jones in believing in mechanical training first. Let the boy leave school at the age of sixteen years. He will have had a public school education of three or four years. He will probably not have gained his First XV. Rugby colours; but he should have a good grounding in mathematics, chemistry, French, and simple mechanics, all of which he can follow up at the Technical School during the succeeding three years, and be prepared for his matriculation examination at the age of eighteen or nineteen. He will during these three years enter the machine shops of a gas-works—learning the use of hand and machine tools, the repair of gas-works plant, steam and gas engines, and the working and maintenance of electrical plant. But, above all, he will have learned in some degree to understand men. He will at that age be willing to act as fitters' labourer, and will consider himself honoured if permitted to operate the steam-hammer for a day, or take a turn in the welding of some small job at the anvil. In other words, he is ready to enter heart and soul into any job by means of which he can show his manliness. In doing so, he will gain the confidence of the men with whom he is working; while, as a result, they will give him every assistance to gain more practical knowledge. At the end of his three years, he will have done three things properly: Learned to love and understand the type of man whom he will ultimately have to control; completed his three years in the shops required by the Institution of Civil Engineers and the Institution of Mechanical Engineers; and have had proper time to study for his University entrance examination.

From personal experience, I feel confident that such training will not produce the kind of gentleman whom Prof. Smithells finds a difficulty in teaching, because his training has been purely mechanical, with the exception of possibly during his third year ordinary works tests; and his evening classes in chemistry and general science will have kept his science-seeking brain fully alive. He would then pass on to the University for his three years' course, during which time he has several months per year in which he can keep in touch with the practical side of engineering if so inclined, and no doubt gas engineers will feel it their duty to give the necessary facilities wherever possible.

At the age of twenty-two, he has completed his shop and University training; and this should be followed by a year in the drawing office, where he would become acquainted with the details of gas-works' design, specifications, and general office routine, which would be accepted as the final year of apprenticeship. He should then be fully fitted for an assistant's appointment.

I suggest that the other methods of combining practice and theory are not so satisfactory, for the following reasons: The man who goes to the University from school has no idea of the value his University training will be to him in his ultimate career; and he is, therefore, inclined to express his energies in terms of sports rather than combining education and sport—to the ultimate result of manly fitness and broad-minded knowledge. Further the man who comes from the University to the shop has a tendency to "know everything" in his own estimation, and fails to a considerable degree in ability to deal with men. Such men I have found it difficult to work with both in civil life and in the Army.

The Scottish sandwich method has many points in its favour; and with a certain type of man it will give the best results. But the average type of men who go to the University from school are not prepared to put the necessary keenness and energy into the practical work during the vacation, with the result that the job is only half done.

The type of man whose father cannot let him have a University training must be given every consideration. Some of our best engineers are men who have worked themselves up from the very bottom. This applies not only to the gas profession, but to all branches of engineering.

Of necessity, the man who has no money at his back is the man who works hardest, provided he has been born with energy and with the desire to rise in the profession of his choice. Such men must have facilities to attain the honours of the profession. I do not suggest that free University courses should be available, though scholarships must no doubt be open to men who cannot afford years from wage-earning to attend special courses, but must do their study at night schools.

It should be here realized that the associate membership of the Institutions of Civil Engineers and Mechanical Engineers are open to men who have taken "B.Sc. Eng.," or similar examinations, from technical night classes, provided that they have been apprenticed to a member of either Institution, and are able to pass a further examination in design and specifications.

May I, therefore, be permitted to urge the suggestion that has been made, that associate membership of the Institution of Gas Engineers should be attainable along the same lines, and be considered in the gas profession as the *sine quâ non* of a duly qualified and trained gas engineer? To attain this end, it is suggested that the Council of the Institution of Gas Engineers formulate rules of apprenticeship and qualifying examinations for studentship and associate membership. Such membership may ultimately be extended to members of the industry with the necessary qualifications. The Civils and Mechanicals do not discriminate between the profession and the industry.

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Mr. J. IRMINGER, JUN., B.Sc.Tech. (Copenhagen), writes: Regarding Prof. Smithells' paper on "The Education of the Gas Engineer" and the interesting discussion (to both of which I listened with very great interest), I beg leave to communicate some of the points I had in mind, and which permission was obtained for me to subscribe to the discussion.

One thing which appears to me to be rather important is that the young student should not leave school until he has gained a sound elementary knowledge of mechanics, physics, chemistry, and electricity, and a firm foundation should be laid by making the subjects interesting by means of demonstrations and experiments in the laboratory. Such a foundation will be found invaluable for further work.

At the age of (say) eighteen the student should commence serving two or perhaps three years in an engineering works, and should preferably be brought into contact with methods and processes demonstrating the ordinary practices of mechanical and electrical engineering. If the student is at all keen, this work will give him an appetite for more knowledge. He will want to know the reason for, and the cause of, the things he observes in the works; and he will be able to appreciate the advantages of obtaining a more intimate knowledge of the different branches of engineering.

At a technical college, the student who has had some practical experience is "handier" when it comes to the practical demonstrations and experiments in the laboratory; and I believe that, generally speaking, he is more anxious to get to the root of the matter, and it is by study only that this knowledge can best be obtained.

There seems to be a general misunderstanding that study means study of theory only. In fact, by far the greatest amount of study which a student has to go through is simply to obtain by reading the practical experience and knowledge which the cleverest engineers and scientists have spent all their lives to accumulate. Study is a short cut to other people's knowledge—bye-passing their early troubles and set-backs.

The University student who has had no practical experience whatever often lacks the broader view which is so great a help in all studies; and after getting his diplomas and degrees, he will find himself handicapped and lost when he gets his first job, and has to deal with men and materials. On the other hand, if a youth spends too long a time on practical work before continuing his studies, he is liable to forget too much of his fundamental elementary education, and will find himself handicapped when he comes to continue his higher education.

I am, therefore, of the belief that two or at most three years' practical experience in a works is the most suitable for a young man before continuing his technical training at an engineering college.

During this training, it is of the utmost importance that the work is arranged in such a manner that his time in the laboratory makes him anxious to get the matter explained during the lectures, and that the thoughts created during the lectures should make him anxious to try things out in the laboratory.

Surely by letting study and laboratory work progress hand in hand and simultaneously, interest is kept alive, the learning of indispensable fundamental principles does not appear tedious, and the best results will be obtained.

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### Pyrex Glassware.

This is a new material introduced by the Corning Glass Company, of New York, as suitable for gas-cooker utensils. It is claimed that the material will not fracture under oven heat, does not chip or flake, cannot rust, burn-out, or discolour, and retains a new appearance after years of use, sufficiently presentable to be brought to table. It absorbs heat rapidly—having the advantage, as compared with metals, of being transparent to radiant heat. A metal pan and a "Pyrex" dish were both filled with water and placed in a gas-oven. In the first, the water did not boil, though left for two hours; in the second, it was boiling in ten minutes.

# B.C.G.A. CONFERENCE AT EDINBURGH.

A District Conference of representatives of gas undertakings in all parts of Scotland was held in the Council Chamber, Edinburgh, on Friday, under the auspices of the British Commercial Gas Association. In the unavoidable absence of the Lord Provost of Edinburgh (Sir J. Lorne MacLeod) on civic business, the chair was occupied at the outset by Bailie WALLACE DUNLOP, of Edinburgh.

### A WELCOME.

Bailie DUNLOP expressed the sincere regret of the Lord Provost that he was unable to be present. On behalf of the Magistrates and Council of the city, he gave them a very warm welcome to the ancient capital of Scotland. He did so all the more heartily because he understood that this was the first occasion on which the British Commercial Gas Association had held their conference within Edinburgh's gates. The Association was in its infancy—it was only seven years old—and he hoped that before another seven years the members would pay another visit. As a member of the Gas Commission of the Corporations of Edinburgh and Leith, he had some knowledge of the aims and objects of the Association, and of the very valuable work it was doing—particularly in keeping well-informed as to all the new and modern improvements, and as to the most approved appliances for gas equipment, and giving information as to these to all who were engaged in the gas industry. The Association deserved great credit for what it had done, not only in this way but in respect that it had always been willingly ready to assist consumers by giving advice as to the best means of adding to their comfort in lighting, heating, or cooking in connection with their dwellings. As they were aware, there were many problems to be dealt with at the present time, all coming under what they called reconstruction. These problems had to be faced by local authorities; and of them all the most difficult and most important was the problem of housing. The people must be provided with well-planned and sanitary houses; and the lighting, heating, and cooking should be of the best character. This was a matter regarding which the local authorities would look to their Association for guidance and assistance. At the present moment there was quite a fierce controversy—in fact, it had been dignified by the name of a campaign—going on as to the relative merits and values of electricity and gas; but he thought he was justified in saying, on the authority of Lord Moulton, Sir Dugald Clerk, and various other scientific and practical men, that, so far as heating and cooking were concerned, gas still held the field. He had no doubt that when the question of building houses was taken up, the provision of gas would have to be carefully considered. He had just learned from a prominent member of the conference that, if it were known beforehand that a house was to be fitted up for gas heating and cooking, the cost per house of four apartments would be at least £30 less. It would be a pity to spend a large sum of money on housing, and then have to make alterations afterwards.

Mr. F. W. GOODENOUGH (the Chairman of the Executive Committee of the Association) returned thanks to Bailie Wallace Dunlop for his welcome. There were two grounds upon which he would like to recommend the Association to those present: First, because it was a British Association, and, secondly, because it was a public service Association. It was British in that the effects of its work were felt from Land's End to John o' Groat's, and even further afield in the British Empire than that. They frequently had evidences from the Empire overseas of the publicity work of the Association, and its effect upon gas undertakings on the other side of the world—New Zealand, Australia, India, Canada, and South Africa. They frequently found that their advertisements were appreciated to such an extent that gas undertakings approached them quite voluntarily to contribute to their expenses, because of the advantages they felt they obtained. When they appreciated the fact that the work of the Association extended so far, he was sure those nearer home would realize that they were benefiting even more. The Association had its headquarters in the South; but the work was proportionate in every part of the British Isles. They chose their Secretary from Scotland, and that might commend the Association in some measure to those present at this conference. He was glad to have the opportunity of paying tribute to the valuable work Mr. Mason did for the gas industry. The Chairman had said that the Association kept the interests of the consumer in view. Good service was the only trade basis for permanent commercial success and real success in life. In the case of the gas industry, they had to remember they were public servants, because they were entrusted with monopoly rights carrying with them corresponding duties. One of the duties in the case of the gas industry was that of doing everything possible to extend the business of the undertaking. As they were the only people who could supply gas in any district, there was a danger that they might not do everything they could to develop the business. As a monopoly, they were bound to get a certain amount of business; and the tendency was always there to be satisfied with what comes instead of going on for all they could possibly get. The war had done a good deal to change this attitude; and he thought every gas undertaking would in the years to come be on the look out for all the business it could possibly get. It was the business of the Association to make this as easy as possible for each subscribing undertaking; and it might not be amiss to mention that they now had as subscribers all the principal municipal as well as commercial gas undertakings in the United Kingdom. The Association represented 83 p.ct. of the gas made in the country. The nation used about 200 million tons of coal each year in providing light, power, and heat—and wasted a great part of it. In the little more than two years the Association was in existence before the war, it had already done a great deal to awaken public interest as to the advantages to the health of the nation, as well as the comfort and convenience of the individual, that accrued from using in place of raw coal its purified essence, gas, and the smokeless bye-product of its carbonization, coke. The Chairman said they wanted to build the new homes of the people with the maximum sunshine and sunlight. They would assure the maximum of sunshine and sunlight if they ensured as little use as possible of smoke-producing fuel. This was an important point that should be borne in mind by all housing authorities. On these points and on the hygienic aspect of heating by gas the Association was always able to produce voluminous testimony. He (Mr. Goodenough) outlined the work which the Association had undertaken during the war, particularly the publicity campaigns organized in the latter stages. Now that the war was over, there were several directions in which the Association could serve the industry and the community. The housing question was one of the most important problems before the country at the present time. Others which were being put prominently forward were transport and coal conservation. While housing was far more acutely interesting to the public than coal conservation, the latter subject had a very great bearing upon the former, because the public had been led to believe, as the result of certain one-sided reports on coal conservation, that the panacea for all or most of the difficulties in regard to housing, transport or coal conservation was to be found in the general use of electricity for all fuel purposes. It was not the policy of the Association to decry or belittle electricity. Its value and its potentialities in many directions were recognized; but it had been proved that electricity would use three or four times as much coal to produce the same amount of heat as gas. In the case of the latter, the bye-products would be preserved for the country; while in an electricity generating station they were destroyed. Figures which had already been given showed that there was an enormous opportunity for gas undertakings to increase their business, if they all put their shoulders to the wheel.

Provost LINDSAY (Leith), a member of the Edinburgh and Leith Corporations' Gas Commission, proposed a vote of confidence in the British Commercial Gas Association, which, he said, had had his consistent support since 1912. He trusted that he might have been, at least in some small degree, instrumental in influencing some undertakings in Scotland to join its membership. It was particularly gratifying that in Scotland the number of gas undertakings outside the Association was very small; and he hoped that, after that day's conference, all gas undertakings would be sowers and reapers together of the magnificent harvest which had attended, and would still attend, the work of the Association. The late Sir Corbet Woodall, in reply to a vote of thanks, when he acted as Chairman of the first annual conference in 1912, stated that the Association evidently had the support and guidance of men of determination and discrimination—men who knew what they were aiming at, and never spared themselves in seeking to accomplish that which they set their minds upon. Lapse of time had given abundant proof that Sir Corbet Woodall's remarks were fully justified. As the representative of the Edinburgh and Leith Gas Commissioners, he (Provost Lindsay) was present at the first annual meeting of the Association held in Manchester, and was much impressed with the objects which the promoters had in view, and the great benefits to be derived by the gas industry if these aims were properly encouraged, fostered, and matured by the whole-hearted support of all those in any way connected with the gas industry. After the full, clear, and incisive remarks of Mr. Goodenough, he would not attempt to elaborate on the policy, organization, and development of the schemes which the Association had in hand, feeling sure that they must commend themselves to all, but would briefly mention outstanding reasons why the B.C.G.A. should receive their active and practical co-operation and support. The Association should be supported because of the important propaganda and advertising work which it carried on with such gratifying success; because of the methods it employed to popularize the use of gas and bring before the public in an artistic manner the varied and most up-to-date gas appliances; and because of the skilful and straightforward manner in which it counteracted the spread of erroneous ideas in relation to the utilization of gas. It was desirable in the highest possible degree that all gas producers and manufacturers of gas appliances should combine together in the Association, and so form a united force to propagate and disseminate the advantages, comfort, and saving in labour which resulted from the use of gas, and to combat, in an intelligent and a tactful manner, the inaccurate and harmful information which, from time to time, appeared in the Press regarding their products and gas appliances. On the subject of the conservation of coal supplies, the important work of the Association in bringing this prominently under the notice of all those interested deserved well-merited praise. The efforts in this direction were already bearing fruit among those whose influence was of importance, and especially those who had to deal with the problems of construction and reconstruction. It was no exaggeration to say that the gas industry was on the threshold of a new era of prosperity, and that fresh fields for expansion were opening up. It only required careful management and guidance at this critical juncture to ensure success both to themselves and to the public for whom they catered. It was, therefore, at this point that the best brains and most experienced organizers were required; and they would be found among those who controlled and guided the destinies of the gas industry through the B.C.G.A.

Bailie J. C. DRUMMOND, J.P. (Convener of the Glasgow Gas Committee), who seconded the resolution, emphasized the fact that there were very few gas companies or corporations in Scotland not connected with the Association. He thought that was sufficient argument in support of the vote of confidence. When they were told that between 80 and 90 p.ct. of the gas made was associated with the "B.C.G.A.," that was another argument in favour of the confidence they could place in the Association. He was glad the Association were interesting themselves in the housing problem. He did not think they could devote their energies to a more pressing need; and the effort was being put forth at the psychological moment. He thought they would be well advised to give a hearty vote of confidence in an Association which had done so much good work, and which would do much better work

in the future when greater opportunities came their way after the signing of peace.

Mr. H. MASTERTON then read the following paper:

## GAS EQUIPMENT IN RELATION TO HOUSING SCHEMES.

At the outset, I should like to explain my appearing before you to-day to open the discussion upon "Gas Equipment in Relation to Housing Schemes;" and I crave your indulgence and leniency for any weaknesses which may occur in the following remarks, because at short notice I have had to fill up the gap caused by various gentlemen, closely associated with housing schemes and who were approached by the British Commercial Gas Association to be with us to-day—being unable to be present owing to important engagements necessitating their attendance elsewhere.

I propose to divide my comments under the following headings and to touch upon the important points relative to: (1) Lighting, (2) Cooking, (3) Hot-Water Supply, (4) Warming, (5) Suggested Schemes and Apparatus.

### 1.—LIGHTING.

As the question of lighting the dwelling is the one round which the greatest controversy is likely to arise, it is fitting that I should refer to it in the first instance. On this subject volumes have been written; and it seems that as of it (like the making of books) there is no end, so I have no doubt that as each housing scheme comes forward, the discussion will have to be gone through again.

It is natural that, as a representative of the gas industry, I should favour our own product; but unless this can be backed-up with facts and figures to prove its utility, hygienic value, convenience, reliability, and economy, my opinion would not carry much weight. It will not be disputed that gas has stood the test of time, has shown its worth under the various characteristics I have just detailed, has been a good friend to the working man and woman, and has many loyal and staunch supporters.

As to our most important competitor it would be unfair not to admit that electricity also has its advantages and disadvantages; and that for intermittent use it is desirable, and has captivated a large section of the community by its wonderful adaptation, its easy manipulation, and the air of mystery and magic surrounding its production and distribution. But we have to get down to hard facts, and consider the two agents on a financial basis. We then find that light for light gas is cheaper; and the longer the lights have to burn the greater the saving in favour of gas. We may take it that in the workman's dwelling the living room will be the apartment mostly occupied, and that during the winter the light here will burn continuously for a number of hours daily; whereas the light will only be required intermittently in the other rooms, so that the more favourable comparison for gas will be in the living room.

Again, we have to consider the effect of the light. It is becoming generally recognized and admitted that the light from the incandescent gas-burner is soft, restful, and better for reading, sewing, and other duties and relaxations in the home. I believe that many headaches, and more ill-health, can be traced to eye strain than is generally realized; and that the electric light rays are more harmful to the eye than incandescent gas lights. This is attributable to the high intrinsic brilliancy of the source of light. With incandescent gas, however, the surface of light-giving material is large, and the luminosity is evenly distributed over the whole mantle. I believe experiments have been carried out to determine the brilliancy of light which the human eye can comfortably endure; and although the incandescent gas light is approximately four times this amount, the disadvantage is compensated for by surrounding the lamp with a suitable globe to diffuse the light over a larger surface. As the metallic filament electric lamp is probably from fifteen to twenty or even more times greater in brilliancy than the human eye can comfortably endure—due to the fine wires transmitting it—it will be seen how much more difficult in this case is the problem of getting a soft and uniformly distributed light. Then it must be remembered that gas when burning gives off heat as well as light; and this heat, by promoting a gentle draught, aids in ventilation and likewise assists in warming-up the apartment without further expenditure. This is of considerable value in cold weather, when there is the greatest demand for light.

It has been found by experience that the substitution of the electric light for gas in some houses has actually led to an extended use of gas, owing to the introduction of gas-fires which require to be lighted in the evenings of the warmer months to remove the chill which often arises during that period of the day, and which was previously compensated for by the lighting of the gas. Another benefit from gas, where it is used for lighting, is its effectiveness in preventing burst pipes in frosty weather—only a small jet having to be kept going for this purpose.

The first cost of installation of the two lights may at the present time be taken as approximately equal; but if the gas-pipes are being put in for other uses, the cost of the extra branches required for lighting is considerably reduced, rendering the comparison greatly in favour of gas.

Turning to the maintenance of the two illuminants, the expense under this heading is much in favour of gas. Mantles cost 5d. or 6d. each; and, with care, two or three of these should be sufficient over a year. Against this there is the cost of a new electric lamp, varying from 3s. to 4s. 6d.

On the question of reliability, the system of gas lighting has stood the test of time; and it is rarely or never that one hears of a breakdown of the system, whereas to show the uncertainty of the electric light it is usual for local authorities to insist (where electricity is installed) in public buildings, such as theatres, picture houses, hospitals, &c., that gas also should be put in as a standby. I have only to mention the sudden burning-out of the electric lamps, the blowing of the fuses, and the fusing of the wires themselves, to call to mind some of the weaknesses of this method of lighting. As the gas commissioners will have to provide mains and service pipes for other purposes than lighting, and considerable capital expenditure will be involved, and taking into account that without further outlay in this direction the lighting of the streets as well as the houses can be undertaken, it seems a useless and quite unnecessary expense to provide and lay electric mains for lighting only.

### 2.—COOKING.

We may with appropriateness now direct our attention to the second heading—viz., cooking. Here we have four forms of fuel to choose from—coal, coke, gas, and electricity. In considering these agents, and weighing-up their relative merits and demerits, we have to keep in view the desirability of:

(*a*) Maintaining a purer atmosphere, which means that our energies should be turned towards the abatement of the smoke nuisance. The subject of smoke abatement has been thrashed-out on many previous occasions, and I may safely say that the benefits accruing therefrom are well recognized and appreciated.
(*b* The necessity for greater cleanliness, convenience, and comfort in the home.
(*c*) The urgent importance of introducing labour-saving appliances.
(*d*) The adaptability of the appliances for the purposes in view.
(*e*) The conservation of our coal supplies.
(*f*) Economy with efficiency.

It is hardly to be expected that it will be possible to abolish entirely, in the meantime, the use of coal; but it is conceded that the extravagant and wasteful kitchen range must go; and in its place a small room grate be fitted in the living room in which could be burned coal or coke (or a mixture of these two fuels) for the purpose of warming the apartment), at the same time providing means for boiling kettles and for modified cooking. The grate would also have fixed at the back a small boiler connected with the storage tank referred to hereafter for the supply of hot water. I believe it has been suggested that the grate might have the top portion in the form of an oven, in which food could be kept hot; but I shall leave the discussion of this part to those who have given special attention to the subject.

We make take it that the gas cooker is now an important adjunct of the workman's dwelling, and indeed of every establishment where convenience, cleanliness, and economy are considered. So the bulk of the cooking, roasting, grilling, and boiling will in all likelihood be carried on with this most useful apparatus. Having determined that the cooker is essential, the next step is to consider where and how it should be fixed, in order to obtain the best service from it. The living room, as its name implies, is not to be used as a cooking department, beyond utilizing the coal fire (which will be required during the winter months for warming the rooms) as far as possible through the day for boiling kettles and for any small cooking requirements.

Our minds being made up that the living room is not suitable for the cooker, it follows that it would be placed in another part of the house, but still in close proximity to the room where meals will be served and partaken of. It has therefore been proposed to put it in what has been termed the scullery or cooking apartment at the back of the living room, but opening out of it, so that food can be quickly and conveniently served therein in a hot condition, plates removed, and all the usual paraphernalia of meals conveniently and quickly attended to.

Considerable controvery has raged round the question as to whether or not the gas cooker should be placed in a recess such as was occupied by the old kitchen range. Many parties advocate this plan; and what I conclude has guided them in their decision is the advantage of having all the hot products from the gas (the steam and odour of cooking) kept within the opening, and diverted into the flue above. Against this, however, has to be urged the difficulty of getting all round the appliance, to keep it thoroughly clean and free from dust; and as cleanliness combined with easy manipulation are among the greatest essentials in cooking, these considerations have evidently weighed with the Women's Advisory Committee in deciding against the recess. From my experience of the matter, I am inclined to endorse their views. I agree that the appliance, in order to obtain the maximum of comfort, and prevent the odours of cooking from spreading through the house, should have a hood or canopy fixed over it, from which a pipe should be led into a convenient flue. This would carry away all steam, odours, and products. The necessary flue would be quite a small affair, as compared with the present kitchen chimney vent, and could also be utilized in connection with the washing copper and the gas-heated water circulator to which I shall presently refer before completing the equipment.

To add to convenience and comfort in cooking, an enamelled back-plate should be fixed on the cooker, and be provided with a movable grid shelf on which dishes and food could be kept warm, and on which the cooking utensils could be conveniently laid. As an alternative for the enamelled back-plate, the wall behind the

cooker might be tiled—that is to say if it is not the intention to put tiles all round the interior of this part of the house. Another essential in the placing of the cooker is that it should be fixed so as to obtain the best possible light to enable the housewife to carry out the cooking with ease, and without unnecessary strain. To this end, the apparatus should be placed near the window, and on a low frame or pedestal, so that the floor all round and under the oven can be kept clean, and the oven itself raised off the ground so as to obviate stooping when examining the progress of cooking going on therein, and to put food into and remove it from the oven.

It is also desirable that the appliance should be set away from draughts, and thoroughly sheltered from them, so that the gas which for many operations is required to be kept quite low may not be blown out.

### 3.—Hot Water Supply.

The provision of a plentiful and adequate supply of hot water is likewise a *sine quâ non* in any housing scheme. I outlined in my previous remarks the proposal to fit into the living-room grate a boiler in which water for domestic purposes could be heated while the coal fire was in use for warming the room; and this hot water could be stored in a tank fitted in the scullery or cooking apartment. It will probably be found that the living-room fire will be sufficient to provide the necessary hot water in the winter months. If a large quantity is required at short notice, the gas-heated circulator fitted below the storage tank can be turned on to assist in this purpose. It is mainly intended that this method of providing hot water should be used during the summer months, when the living-room coal fire is not lighted, as at this season all cooking would be done on the gas cooker.

One of the difficulties which the makers of these gas-heated appliances had to contend with was the fluctuating quantities of hot water which are needed from time to time in a household, and which have generally been met by providing good storage accommodation to guard against any shortage and to meet emergencies. This is now recognized as a wasteful method, and does not always secure the end in view. The difficulty has been overcome by the introduction in the gas-heated circulating system of what is known as an "Economy" valve, by the manipulation of which varying quantities of water can be heated-up—depending upon the purpose for which the hot water is wanted. For instance, for the usual run of household duties (such as the washing of dishes, floors, &c.) only a few gallons of hot water are necessary at one time. To obtain this quantity, the valve is manipulated so that only the water in the upper portion of the tank is heated. When larger quantities are desired, the valve is turned round so that the entire contents of the storage (15 to 20 gallons) are warmed up. In order to still further economize the gas, an additional important device is introduced, known as a thermostat. By the use of this, as soon as the water has reached the pre-determined temperature—generally about 150° Fahr.—the gas consumption is automatically cut-down to an amount merely sufficient to keep the contents at the determined temperature. After a quantity of hot water has been drawn off, the gas supply automatically opens-up, allowing a sufficient consumption to take place and heat-up the contents again.

Varying ideas exist us to the capacity of the storage tank which should be provided for hot water; and it is important that the point should be settled satisfactorily and on an economical basis, as on this depends the success of the arrangement.

I have come to the conclusion that a tank of 14 to 15 gallons capacity would be sufficient for the workman's house; and I am convinced that this size would provide for all normal needs, and prove inexpensive in working. The tank would of course be supplied with an "Economy" valve, so as to heat-up either 5 gallons for ordinary daily purposes or the whole 15 gallons when a bath is wanted. I have been guided to this conclusion as the result of experiments which we have carried out with the apparatus; and a few figures may here prove useful. If the whole contents of the tank—say, 15 gallons—be heated up to 150° Fahr., and the water is required for a bath, it will be found that this quantity, to which would be added cold water, would provide a bath of 22 to 25 gallons at a theoretical temperature of 120° to 114° Fahr.; and I think it will be admitted that this amount and temperature are all that could be desired after allowing for the cooling effect of the bath itself and the atmosphere. The practical results gave a hot bath in 45 minutes consisting of 22 gallons of water at a temperature of 104° Fahr. with a consumption of 36 c.ft. of gas.

It should be noted that the gas-heating would be utilized mainly in the summer months when the temperature of the water is at its highest. Consequently, the smallest quantity of gas would then be consumed in the operation.

For the weekly washing, nothing is more cleanly and economical than a gas-heated washing copper which, for a workman's dwelling, should be of from 10 to 12 gallons capacity. This apparatus can be turned on at any time, and the washing performed without any dust, dirt, or the carrying of coals and the removal of ashes, such as take place with the ordinary coal-heated boiler. The gas-boiler takes up much less room and can in an emergency be used for heating-up water for any special purpose.

### 4.—Warming.

At this time the utility, convenience, comfort, and necessity of a gas-fire in the house call for few remarks from me; but I think it is opportune to remind those who have to design and carry-out schemes for housing, that the cost of providing and fixing a gas-fire (which is really essential in at least one bedroom) is little if anything more than is required for a coal grate. The gas-fire will afford a ready means of warming the room in case of illness or for an invalid, without causing labour, dust, dirt, or worry. Again, there is the saving in labour and material in the building of the chimney breast and flues, as the flue for the gas-fire need only be about one-half the size of the coal-grate vent. The gas-fire can simply be built on the front of the wall and tiled round, or facing-bricks can be used for this and also for the mantelshelf. Or this part of the wall can even be finished in rustic brickwork. Gas-fires in each case can be chosen to suit the design, as there are now patterns to meet almost every variation in style.

The cost of the piping, if put in when the structure is being built, is practically negligible; and the expenditure is justifiable and important. Indeed I would advocate a pipe being led to each fireplace, because as soon as the benefits of gas-fires are recognized and experienced, more of these warmth-giving appliances will be demanded. In fact, I think it possible to construct and fit them so that they could in an emergency be moved from one room to another.

To revert to coal-grates. It seems wasteful and extravagant to go to the expense of providing them (along with vents, chimney breasts, &c.), and then to place gas-fires in front of the grates. And although gas-fires have been made adaptable for this purpose, the arrangement is seldom entirely satisfactory. The effect at any rate does not give that feeling of harmony which is procurable when everything is designed by the architect in unison from the first.

I have made out a few simple and inexpensive designs of gas-fires and surrounds merely to demonstrate what can be done in this direction; and I am sure if those trained to this class of work will give it their attention, and bring their experience to bear on it, the results will be highly gratifying.

### 5.—Suggested Schemes and Apparatus.

By the courtesy of Mr. Williamson, the City Superintendent of Works, I have obtained prints of some of the types of houses prepared by him in connection with the Gorgie Housing Scheme. These [as exhibited] show in plan and elevation how the various gas appliances detailed in the foregoing remarks can be arranged and fixed. The drawings will give an idea of the general effect, and also afford an opportunity for discussion. I have slightly altered Mr. Williamson's design, simplifying the arrangement of the gas apparatus and separating more effectively the cooking apartment from the living room. In these plans we have delineated both the gas service from the main to the meter, as also the pipes leading to the various appliances. As regards the meter, I am of opinion that this should be of the prepayment type; but as more gas will be consumed than is customary with the penny-in-the-slot variety, I am taking-up with the manufacturers the possibility of obtaining a meter which could be manipulated with either a sixpence or a shilling.

Although this is a more expensive way of distributing gas than with ordinary meters, gas undertakings would probably be willing to go to the additional outlay, as the risk of bad debts is greatly minimized, and the money is collected at shorter and more regular intervals. Besides this, it is the popular form of payment among working-class consumers.

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Mr. Goodenough, who opened the discussion, expressed the thanks of the conference to Mr. Masterton for his comprehensive and practical paper. At the first district conference, they had considered the question as to the actual saving in the cost of a house if it were constructed for the use of gas in the first instance, instead of being constructed for coal and the gas superimposed upon it, as was so very generally done without a satisfactory result, or far from the most satisfactory results. He was pleased to say they had with them Major Wheeler, an architect who had gone into the question, and who had prepared the plans exhibited, showing a house first of all built for coal grates with ordinary chimneys, and afterwards constructed to take gas-fires, with the flues that would be required for this purpose. The saving worked out at about £30 per house. Major Wheeler also showed them plans of a block of offices for a firm in London, which he first designed for the use of coal-grates and afterwards designed for the use of gas fires. After consideration, the firm in question decided to use nothing but gas fires. These plans would show not only a saving in the cost of the gas-constructed house, but a very substantial addition to the floor-space and the cubic capacity of the rooms. Mr. G. J. Swain, an architect who had carried out a great deal of building on behalf of Messrs. Rowntree, of York, had also dealt with this matter. He said:

> "For building costs in connection with the all-gas house, very few realize the cost per cottage incurred in the construction of chimney breasts and stacks. The ordinary cottage as built at New Earswick requires 19,592 bricks; and of this number 5000 bricks were necessary to build chimney breasts and stacks. Thus the all-gas house would save in bricks alone £20. Taking the value of bricks and labour at the present time, they would have a saving of at least £42. Therefore from an economical point of view, I recommend the all-gas house in all seriousness. But if you are to do so satisfactorily and get sound results, do not build a coal-fire house and then try and adapt for all-gas. Otherwise you may have failure. But design and build entirely for gas, and you will reap boundless satisfaction. It only takes a few short weeks to get used to the change, and you can take it from me that people who cannot afford a maid-of-all-work will never want to go back to the coal scuttles, ashbins, and dusty hearths."

This was the testimony of a practical architect, proceeded Mr. Goodenough, and one who had had a great deal to do with the housing of the working classes. On his figures, if gas-heating was adopted

in the 500,000 houses which would be built in the coming few years throughout the country, 250 million bricks would be saved, or about 15 million pounds sterling. These figures were worthy of the consideration of all who were designing houses. Referring to Mr. Masterton's point about the value of gas-lighting—in that it provided a certain amount of heat, while the light was principally used during the colder period of the year—Mr. Goodenough instanced the case of a firm which built workmen's dwellings and insisted on putting the electric light in. At the end of a not very long period, the firm asked that gas-lighting should be installed. They found the inhabitants would not use electricity, but preferred to use oil-lamps because they gave warmth, and the oil did not cost so much as the electricity. In calculating the comparative costs of using gas and coal (this did not apply so much in the case of workmen's dwellings), they should take into consideration the saving of labour in the case of the larger houses. It was a fact that, for intermittent heating, gas consumed in properly constructed gas-fires was cheaper than coal even in the case of the artizan's home.

Major F. CORNELIUS WHEELER, dealing with the aspect of economy in building construction, said that in view of present-day prices of materials for the building trade, any means by which economy of construction could be obtained without impairing the efficiency of a building, should receive every consideration from prospective building owners, or corporate bodies about to embark in building schemes. While in no way wishing to enter into the realm of debate regarding the respective merits or demerits of coal *versus* gas, by a scientific use of the latter product, he thought great economies in building construction could be secured, and the effective ratio of heating amply maintained. For many centuries coal had been the general means adopted for the warming of our homes; and while he would be one of the first to admit the cheerfulness and charm of a coal-fire, yet the use of coal in a grate involved a method of construction and additional labour which were both extravagant and unnecessary. The presence of bold chimney breasts terminating frequently in ornate chimney stacks was considered by many to add architectural and æsthetic beauty to a building. There were notable examples in this country where the sole charm of a building or the only claims to artistic distinction were these stacks. On the other hand, the artistic beauty of the average house erected for practical purposes was in no way enhanced by chimneys, which had a habit of springing out of the roof somewhat sporadically. The principal economy could be effected by curtailing the use of the chimney stacks when building our future homes. Take in the first instance the type of small villa (detached or semi-detached and grouped in terraces of four or more) that it was proposed to erect in urban and rural areas. The average house would consist of a living-room, scullery, parlour, and (say) three bedrooms. The living-room was the one place where a coal-fire was essential to the comfort and convenience of the inmates. The parlour was only used for short periods. Therefore, a gas-fire was the most convenient and practical proposition in this kind of room. A fire in the bedroom was only made use of in case of illness. Why, therefore, go to the expense of building large chimney breasts and smoke flues, and chimney stacks 3 ft. higher than the ridge of the house, solely to carry away the bye-products of a coal fire, so seldom used? The point to be considered was what saving on the cost of the building could be effected by the use of gas-fires in the four rooms referred to. In the plans hung on the screens in the conference hall, they saw the ordinary method of construction, using all coal fireplaces, and how it was proposed to effect economy of construction by omitting the chimney breasts to the rooms other than the living-room. It would be seen that, by using gas-fires, only small flues, about 12 in. by 3 in., built in the thickness of the 9 in. walls, were required. Thus, they would at once save the cost of brick chimney breasts, stacks, concrete hearths, skewback arches, trimmers, brick footings, and foundation concrete which were essential to the construction of coal-fires. The comparative costs had been carefully worked-out by an eminent London quantity surveyor. A bill of quantities was prepared in each case: (1) Coal-fire construction; (2) gas-fire construction. A priced bill by a firm of builders showed that a saving of 50 p.ct. could be effected by adopting the second plan, which in the case illustrated amounted to £60 per pair of cottages. There was a further point that must not be lost sight of. By eliminating the chimney breasts, an additional floor space of 172 sq.ft. was obtained, and an increased capacity of 2924 c.ft. Or, conversely, in a group of four cottages, the stipulated floor-space and cubic capacity could be given, and yet a saving be effected of 2924 c.ft. of construction. All this reduction was made possible by the use of gas-fires in the parlour and bedrooms, while still retaining a coal-fire in the principal living-room. The second example of which plans were shown was the case of a block of offices being erected in the City of London. It was the architect's original intention to build the usual coal-fires and chimney breasts. A brief examination of the plans would show that the site was a limited one, and the rooms consequently small. By adopting gas-fires, a very obvious saving in cost of building had been effected, and a considerable addition to the floor-space and cubical contents had been achieved. These results were:

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| Reduction in cost of building . . . . . | £180 |
| Increase in floor space . . . . . | 96 sq. ft. |
| Increase in cubic capacity . . . . . | 4992 cu. ft. |

On the top of the economies effected, the modern scientifically designed gas-fire, which was entirely without smell and noiseless in action, was of the greatest comfort and convenience in the modern office, as any temperature could be obtained at any hour, while the labour and dirt involved in maintaining coal-fires were no longer a necessary evil. Again, chimney stacks had no æsthetic value in city office construction, no matter how grand the architect's conception might be. Another small gain was occasioned by the fact that no longer was one at the mercy of a chimney sweep, whose attention (spread over a term of years) amounted to quite a considerable sum. It was hoped very shortly to publish the actual savings effected by this method of construction, as his illustrations were concrete cases and not plans selected to prove the economies advocated.

Mr. ALAXANDER WILSON (Glasgow) said the Association could do a great deal in assisting with the housing problem. They should press upon all municipal authorities who were taking up schemes the advantages of the gas-fire, and if it was at all possible, they should get permission to erect a model house, so that the possibilities of the scheme could be seen.

Mr. SAMUEL MILNE (Aberdeen), who made an appeal on behalf of the Association, said that when he saw the amount of work the Association were doing on behalf of the industry generally, he thought they were getting a real benefit out of their membership. He was sure they all heartily agreed with what Mr. Masterton had said, and from Major Wheeler also they had received information which would certainly be of use and interest. The conservation of coal was of vital importance; and they had at hand the proper method to apply to its conservation. They had it in the gas-fire and the gas-cooker. It was a remarkable fact that, while there were hundreds of thousands of gas-fires in use, probably about 90 p.ct. of them were afterthoughts. This he knew would be remedied, because gas-fires were now being constructed on the proper lines. With a view to coal conservation, and having regard to the residual products obtained, the gas industry stood high for efficiency. But it did not concern the consumer very much how efficient gas was in thermal units or compared with coal. What concerned him was the "*£ s. d.*" aspect. They had heard about the cleanliness and so forth of the gas-fire, and all agreed. But he did not think anyone present would say the gas-fire could compete with the coal-fire in the matter of cost. It might, of course, in the case of a bedroom; but where a fire burned continuously for ten to twelve hours a day, the gas-fire would not compete with the coal-fire. There was the sentimental point of view also in regard to the coal-fire. Most people liked to sit beside a coal-fire; and though he liked to do so himself, he would not have a coal-fire in a bedroom or a parlour. They heard a good deal about the nationalization of coal mines; and when this came, it was just possible there might be a premium put upon all coal burned in the raw condition, and perhaps a subsidy for those who used gas. It had been given out by Sir Dugald Clerk that the relative efficiencies of gas and electricity from the thermal point of view were four and one. From the "*£ s. d.*" point of view, he thought it was more like seven or eight and one. On the question of motive power, while for heavy and continuous loads electricity would never compete with gas, for light intermittent work the electric motor had come to stay, and they would not displace it.

Mr. D. J. BLACK (Cambuslang) also thought that a considerable saving could be brought about by the installation of gas-fires. A good many references had been made at the conference to the need for working-class houses. He would remind them that the middle class required houses as well as the working class; and for that matter he might almost add that the definition of the working class had always been a mystery to him. He would suggest that the Association might direct itself to the task of educating the working class to the uses of gas for purposes other than for illumination.

Provost LINDSAY (who was now occupying the chair) expressed his gratification at the excellent addresses they had listened to. There were evidently several directions in which economies could be made by introducing gas appliances.

Councillor DOUGLAS ELLIOT (Edinburgh), in moving a vote of thanks to the speakers, thought the Association should take means to bring the various points referred to at the conference to the notice of the different authorities throughout the country who had housing schemes in hand, and also the various architects. With regard to the addresses to which they had listened, they were particularly grateful to Mr. Masterton, who had come into the breach at the last moment. They were indebted also to Major Wheeler for his interesting statement.

Mr. W. M. MASON (Secretary of the Association), in supporting the vote of thanks—and including in it the Corporation of the City of Edinburgh for their kindness in granting the use of the Council Chamber and for extending hospitality to the members—also referred to the matters which had been discussed during the afternoon. He believed not so much in an all-gas house as in a smokeless house. The women in the home must be considered, and would be considered—because woman was coming into her own. Women in the future would not put up with a house where it was going to be drudgery from morning to night for them. He also expressed the thanks of the conference to Bailie Wallace Dunlop and Provost Lindsay for having presided at the different stages of the meeting; and he also remarked upon the fact that the Waverley Association had postponed a delightful trip that afternoon so that the members could co-operate in the conference.

Provost LINDSAY, responding to the vote, expressed the hope that some practical advantage would come out of the conference, not only to themselves but to their helpmates, and to housewives throughout the country.

## Benzol as a Motor Fuel.

Mr. J. Arnold Norcross has sent to the "American Gas Engineering Journal" the results of some tests which have been made by the New Haven (Conn.) Gas Light Company of the comparative value of benzol as a motor fuel. While warning readers against building too much upon these tests, he suggests that they may serve as an encouragement for others in the gas business to develop a local market with automobiles for benzol and toluol. A test on dry roads one windy day last March resulted as follows: A mixture of 50 p.ct. benzol and 50 p.ct. toluol, ran 17·8 miles per gallon; with benzol alone, 22·5 miles; a mixture of 50 p.ct. benzol and 50 p.ct. gasoline, 17·8 miles; gasoline alone, 14·1 miles. Compared with gasoline, the benzol and toluol mixture was 26·24 p.ct. better; the benzol and gasoline mixture also 26·24 p.ct. better; and benzol alone 59·57 p.ct. better than gasoline. In all cases the carburettor was readjusted to meet requirements. Subsequently, on a different make of car, this superiority of benzol was confirmed. The average of three tests each made with a gallon of benzol, was 21·9 miles; with a gallon of gasoline, 15·03 miles. The average increase in mileage of benzol over gasoline was thus 45·71 p.ct.

# WAVERLEY ASSOCIATION OF GAS MANAGERS.

## ANNUAL MEETING IN EDINBURGH.

THE Annual Meeting of the Waverley Association of Gas Managers was held last Friday in the Cockburn Hotel, Edinburgh, Mr. ALEXANDER BISHOP (Newtongrange) presiding over a large attendance.

In order to save time, and unnecessary travelling, the Committee decided to agree to the request of the British Commercial Gas Association that the afternoon should be given up to the larger interests of the "B.C.G.A."; and accordingly the members attended and took part in the District Conference of the Association which was held in the City Chambers in the afternoon—presided over by Bailie Wallace Dunlop.

### DECEASED MEMBERS.

The PRESIDENT, at the beginning of the proceedings, said he thought the memory of the late Mr. Alexander Mackenzie deserved some special mention. The deceased gentleman was one of the original members of the Association, and until recently he was able to assist in carrying on the work for which it was formed. Among the members of the gas industry Mr. Mackenzie was highly respected for his attractive personality, genial sympathy, and the facility with which he made himself popular wherever he went. A letter of condolence had already been sent to the relations by Mr. Cowie, the Hon. Secretary; but he did not wish the occasion to pass without making some reference to the appreciation which the members had for Mr. Mackenzie during his long and intimate connection with the Association. By the death of Mr. J. B. Scott, of Cowdenbeath, the Association also lost a valuable member.

### A VACANCY TO BE FILLED.

Mr. R. W. COWIE (Hon. Secretary) intimated that Mr. Masterton had been asked by Principal Laurie if he could recommend anyone to take up the teaching duties in the Heriott-Watt College which, prior to the war, had been discharged by the late Mr. Henry O'Connor in connection with gaslighting and kindred subjects. This was a good opportunity for anyone to adopt the teaching profession. He could speak from experience of these classes, because he had taken them up occasionally in the evenings or Mr. O'Connor.

## THE PRESIDENT'S ADDRESS.

At the last annual meeting of the Association you conferred on me the high honour of President; and I can assure you I appreciate it, and trust that this meeting will prove as beneficial, as interesting, and as sociable as have its many predecessors.

### THE WAR.

I cannot refrain from making reference to the war. After four-and-a-half years of great destruction of life and property, peace is now in sight; and it is to be hoped it will be a lasting one. In this hour of victory, we cannot forget those brave men who lost their lives or suffered in bringing victory to the Allies, so that the nations will be free once more to devote their energies to furthering the peaceful progress and happiness of mankind.

Much has been heard of many industries making large profits at the expense of the taxpayer. The gas industry, however, cannot be accused of this, as it has come out of the struggle poorer in material wealth than when it entered it. We were asked to "keep the home fires burning," but ours has nearly been extinguished under the Defence of the Realm Regulations. We have had to pay greatly increased prices for coal, material, and labour; and as a result the price of gas in nearly every case has had to be increased.

If the war has brought its troubles, it has also brought its rewards to the gas industry. It has helped the industry along the road of development, and has urged it to establish itself there by perseverance, and not to be deterred or dismayed by the obstructions of decrepit ideals. Change has come into the industry; but I think the greatest change is in men and their ideas. Without such a change, there could be no road to progress. Many new ideas have been brought forward, some of which were only suggestions to meet the immediate necessity of the times. Others were of a more permanent nature; and it is just possible that some of the temporary kind may become part of our permanent system of working. For instance, there is steaming in horizontal and vertical retorts—a process in gas manufacture which will, I think, have a far-reaching effect, especially in the latter type of retort.

### FUEL ECONOMY.

One of the questions that has been forced on our attention by the war is that of fuel economy and the conservation of our coal supplies. Coal is vital to the gas industry. It is more than that—it is the foundation upon which the whole industrial prosperity of the country has been built. There is hardly any question of more vital interest to a manufacturing nation like ours than that of the price of coal, or (to be exact) the price of light, heat, and power, and the bye-products obtainable from the coal. As a nation, certainly there is no natural gift we more wastefully misuse than coal in the factories, houses, and on our railways. In the matter of coal, there is almost infinite scope for scientific inquiry, research, and development. If the resources of the country are to be properly conserved, it is obvious that gaseous fuel will play an important part in the future.

The gas industry makes better use of coal in the country's interest than does the electricity industry; and it seems to me that carbonization of coal, recovery of bye-products, and the production of gas in greater volume than by the present methods are the lines likely to be followed in the future. Naturally, the quality of the gas will be less, because, in order to arrive at the greatest result in carbonization, it is necessary that we should obtain a larger quantity of gas from the carbon content of the coal. Evidence of this was to be seen in recent practice with vertical retort installations. The gas-works which are to-day equipped with vertical retorts are undoubtedly in a strong position in regard to costs and labour troubles; also, they have made considerable advance in the conservation of coal. This advance was rendered possible by the more general recognition of calorific value and the abandonment of luminous value. Production is, I think, the direction in which the industry must look for the largest relief from the new financial disadvantages, and for giving fresh impetus to and maintaining the gas business.

### THE COAL PROBLEM.

The problem of coal supplies still remains unsolved; and so far as can be seen nothing but the maintenance of the price of coal at the present high level can meet the concessions recently made and accepted by those engaged in the mining industry. Now that they have accepted the concessions, they are as keen as ever for the nationalization of mines. As the word indicates, this is a question for the whole nation; and it would appear that the whole country should have a voice in such a great reversal of policy. In any case, a change of some kind is bound to come; and whatever it may be it is to be hoped it will bring to an end the constant unrest that has prevailed in the coal industry. It is just possible that if the State takes over the collieries and railways, our turn may come next. If it does come about in our case, it will probably be on the grounds of the conservation of coal.

### COKE.

As a result of the high prices charged for coal, it is gratifying to find that the demand for coke for almost all purposes has increased to abnormal proportions; and as a result we have been able to obtain much better prices. It is also pleasing to learn that the large stocks of coke throughout the country are almost sold-out. One gratifying feature in connection with the present demand for this product is the manner in which householders have used the fuel for domestic purposes. In future our aim should be to take advantage of the free and practical advertisement coke has obtained in the past year by endeavouring to do our utmost to retain the custom we have recently acquired.

### TAR.

As a result of a stagnant market for pitch, large stocks of which are being carried by manufacturers throughout the country, low prices have been paid for tar. While some undertakings have not been affected by the recent low prices, others have not been so fortunate; and for some time there has been a strong feeling among gas managers that they have not been receiving a fair price for crude tar. The Scottish Gas Council took up the matter with the distillers; and the former drafted a scheme for the sale of tar and ammoniacal liquor by gas undertakings to distillers, which has been accepted by the latter with the single exception (Clause 4) which prescribes that they desire contracts to be for a period of not less than two years, with six months' notice in the case of gas undertakings deciding to erect tar-distillation plant or dehydrating plant of their own. I am sure that a better feeling will exist in future between buyer and seller, as under the scheme a fair price will be obtained for tar and ammoniacal liquor.

### SULPHATE OF AMMONIA.

For many years previous to the war much useful propaganda work had been done; but all efforts did not, and could not, put sulphate in such a prominent place as the war has done. The home product is an absolute necessity now—eagerly sought after by all who are interested in, and anxious to increase, the production of food; whereas before the war it was difficult to get it used. The war will, I think, have swept away much prejudice concerning its use; and now that most farmers have found out how to use sulphate (owing to the fact that foreign nitrate could not be bought in sufficient quantities), I am sure the new order of things will beneficially affect the gas industry.

### RESEARCH.

As in other things, the war has been the means of drawing increased attention to the value to industry of systematic research. The research into the composition of gas best adapted for general use, and into the qualities of refractory materials, are sure to yield fruitful results. Also, fuel research is another matter which is pregnant with great possibilities for the gas industry. It is

absurd to suppose that the Germans had any special endowment in scientific pursuit. They scored, not because of superior scientific capacity, but because they were quick to adapt and apply to practical purposes discoveries which in many instances were British. The Germans believed in science because they made it pay; and they made it pay because they were willing to spend money in research, and await results with patience.

CENTRALIZATION OF SUPPLIES.

Centralization of gas supply was not only practical but essential from the point of view of economy. It was possible to distribute electricity by means of high voltage in remote districts; and in the case of gas there should be no difficulty in applying the high-pressure system—more especially when the gas will be of a quality suitable for compression and transmission to distant outlying districts. As centralization in production must make for economy, it would benefit both central gas-works and outlying districts when the former took over the supply of the latter from undertakings which, owing to their capacity, and perhaps location in regard to transport, are not well conditioned for economical manufacture. At present we hear of great schemes for generating electricity on a large scale at various centres. If this is done, surely the coal will first be carbonized, and the residuals recovered; and if this should be done, then it would appear more feasible for gas-works and electricity works to supply one another at a cheap rate and develop side by side. As gas and electricity are public necessities, there is no reason why they should not be run in combination. In Scotland we have one instance where the combination of running a "gas-electric" station presents a striking illustration of the possibilities of the conservation of our fuel supply.

NATIONAL GAS COUNCIL.

The influence of the war has brought the gas industry into prominence, and has helped towards a complete organization of our forces, as a result of which we have now a National Gas Council representing the industry—the first time the industry has been fully organized. Great responsibility rests on the Council; and it is on questions of policy, administration, and legislation that the Council will be of the greatest service to the industry. The war has proved how in the past the gas industry has been crippled by misguided regulations; and the Council will, I am sure, see that the fetters are not reimposed. The inclusion in the membership of the Council of conveners and directors of municipal and company undertakings provides for them not only direct interest in gas affairs in their wider aspect, but also secures the influence and authority of corporations and companies. Surely this should be for the benefit of the industry.

GAS SERVICE IN NATIONAL HOUSING SCHEME.

In connection with the building of thousands of houses, it cannot be denied that the gas industry has a definite part to play in the great movement; for gas is pre-eminently a means of securing economical efficiency in household management and of reducing domestic drudgery, with which women have had to struggle in the past, and which for the sake of the nation as a whole it is essential to abolish in the future. By means of District Conferences, the British Commercial Gas Association are making great efforts to spread enthusiasm for new business throughout the country. These Conferences will, no doubt, be beneficial; but they will only be beneficial if action follows discourse. The British Commercial Gas Association cannot achieve the full measure of success if it is not backed-up by local effort in the area of every gas undertaking in the country. There should be no local person in the country with a voice in the councils of public bodies having the destinies of housing schemes (or any other scheme at their disposal which concerns the use of light, heat, and power), who are not fully posted-up with information as to what gas can do.

Before this ideal can be achieved, however, much publicity is needed; and it is necessary that every gas undertaking should assist in the building-up of this great ideal system. No good purpose is served by hiding a light under a bushel. Gas undertakings have, I think, in the past exhibited too much in this direction, while rival undertakings, less favourably circumstanced in the economic production of their only commodity, have set their beacon on a hill. In the promising and unlimited future which undoubtedly lies immediately ahead of the gas industry, strenuous efforts should be made to eradicate every hindrance and obstacle; so that the public generally may obtain at the lowest possible cost the utmost service of the gaseous commodity which best serves its purpose.

It appears to me that the two principal conditions which have to be observed are: First, that the gas should be of such a quality as will enable the gas consumer to obtain the very best results at the lowest possible rate, and that its quality and composition, and the pressure at which it is supplied, should be kept as constant as practicable. The second condition is that it shall be of such a character that it can be used without causing deposition of the solid hydrocarbons which in former years it produced, and which it also occasionally produces at present—causing such inconvenience to users and trouble and expense to suppliers, under the name of short supplies, stopped service pipes, bad gas, &c.

With regard to the first condition, I do not think there is anyone connected with the industry who will deny that the gas which is required at the present day is one that possesses a reasonable and constant calorific power, quite independent of what its illuminating power may be. It is the duty of every engineer, therefore, to adopt such methods in the process of manufacture at his works as will enable him to place at the disposal of consumers a gas which is calculated to give the very best results under the changed conditions of modern-day requirements. Having got a suitable gas, we next must have efficient gas-consuming appliances, and also an efficient distributing staff.

THE SALARIES QUESTION.

If ever there was a time when good salaries should be paid it is the present, with all its tear and wear upon officials and the high cost of living. In the reconstruction work of the industry, inadequate salaries should be looked into; for responsibilities have become greater, and the industry must offer prospects that will attract to it the right men. Without the right men, however good the policy framed, there will be little chance of its being universally carried through.

## DISCUSSION.

Mr. D. VASS (Perth), after complimenting the President upon his able address, said the members had heard a good deal about the Government's huge scheme for the centralization of electricity; but he did not think any of them were greatly impressed with it. It was possible to centralize too much; and this remark might also be applied to gas-works. If centralization, in the Government's sense of the word, was applied to gas undertakings, it had been said that big cities would be able to make gas cheaper than any others. Was this a fact? Analyze the large gas undertakings in Scotland, and eliminate the capital charges, and it would be found that some of the smaller gas-works were making gas more economically that the larger ones. Centralization should not be carried to extremes in gas undertakings. In regard to the housing problem, there was a great opportunity for gas engineers to show what could be done in economizing supplies, and in adding to the comforts of the household. The first thing that the householder who purchased his own cottage generally wanted to do was to make the scullery into a kitchen, and convert the kitchen into a parlour or living room. The back kitchen in such a case as this could be made much more comfortable by the use of gas, and altered, even to the extent of putting in a copper for washing. Where electricity was being pushed, the gas manager should try and get gas supplied to the kitchen, which was the main factor in the working-man's home. He admired the Chairman's ideal of a fairly steady and regular grade of gas that could be depended upon at all times to give almost equal results. Since the war many of them had stopped washing, and were allowing the benzol to go forward. He did not know if any of them had had the opportunity of testing the effect of doing this. There was undoubtedly a loss of benzol before it reached the distributing area. The calorific value of the gas at works situated two miles out of the town dropped 10 p.ct. before it reached the centre of the town where the testing station was. This was entirely due, he thought, to the benzol having condensed out on the way. It was false economy to leave the benzol in the gas; and he, therefore, supported the Chairman's idea of reducing the gas to its best carryable quality. Among the complaints they received regarding the quality of gas was that it varied one day from another.

Mr. R. HAMILTON (Dalkeith) said the point that provision should be made in the back kitchen for cooking purposes could not be too strongly emphasized. It should be impressed upon town councils that a specific place should be provided for the gas-cooker. If this were done, the cooker could be kept in much better working order.

Mr. J. D. KEILLOR (Hawick), referring to fuel economy, said the gas industry had done more in this matter than any other industry. Coal, of course, was vital to the gas industry. Without it, they could not exist. But gas was essential to the masses of the country; and a cheap and efficient supply was, in his opinion, second only to cheap food. The charge of exploiting the public could not be laid at the door of the gas industry. Their price was regulated by the price of coal. If gas undertakings were ever put under State control, he did not think it would be on the ground of coal conservation. It would probably come because the gas industry had lost its opportunities and mismanaged its own affairs. With regard to centralization, which had become a "hardy annual," it was beyond dispute that gas could be distributed in wider areas in a way that could not be done with electricity. In the matter of gas for housing schemes, they must be active and watchful. The lack of interest in ventilation by architects was amazing. They should try and bring about such building reforms as would make the introduction of gas for light, heat, and power a sure and safe thing.

Mr. JAMES DICKSON (Johnstone) expressed appreciation of the view taken by the President of the future of the gas industry. The most important matter that was facing them at the present moment, he said, was the question of money. They had got the men now, and would probably soon get plenty of material; but they could not finance all the schemes they were looking forward to without raising the price of gas to a limit that would reduce consumption. Therefore the great question was, where was the money to come from. Perhaps it would be easier to get money after the Government's new loans had been subscribed. The electrical industry was being financed to extend its interests and ramifications, while in the gas industry they did not see any great prospect of raising sufficient capital. It would require a large amount of money to carry on in the realm of industrial and domestic heating, and to enable them to tackle their arrears of work. Consumers were crying out for cookers, and they would be crying out for fires and other appliances also. The question of finance was one of the greatest difficulties they had to contend against. Tar distillers did not seem to think that gas-works had to pay their way as well as tar distilleries. But tar prices were now improving; and he was sure that the scale referred to by the President, when put into working shape, would in years to come make for the betterment of prices and the reduction in the cost of coal. The prices of pitch and creosote had gone up considerably since the beginning of the year; and the sliding-scale would act in favour of those who wished to take advantage of it. With Mr. Vass, he thought centralization could be overdone. They had been run from London for four or five years, and they knew what had been the effect of centralization. That it had not resulted in

quite as much good as was hoped for, was proof that it could be overdone, and that in many cases the medium-sized works could carry on as economically as the bigger ones. But the smaller works would stand to gain by being combined, and the supply distributed from a larger centre. He then referred to the question of fuel research, and expressed the hope that means to regulate prices to the community would be embodied in any recommendations that were made. He also hoped that the sliding-scale would be determined by the calorific value of the gas and a standard price fixed for a calorific value. The interests of the consumer, it was evident, were to be safeguarded in the future—he was not to have foisted upon him something that was not good heating gas.

Mr. David Fulton (Helensburgh) said it would be time enough when they saw the new houses built to worry about getting gas into them. Meanwhile, it was all talk and no houses—a great deal of "cry," but very little wolf. With regard to salaries, it seemed impossible to get gas managers to organize in the proper way. He had suggested on a former occasion that, where a gas manager was not fairly treated, he should join the workers' union; so that in the event of a dispute it would not only be the manager who left the works but the whole crowd. With regard to quality, he was an advocate of a low-grade gas, which he had been supplying for over seven years. Manufacturers had lately been advertising in a large way that they were putting on the market new cooking appliances which had double the efficiency of those in use. He recently called the attention of one of the manufacturers to the fact that in his (the speaker's) small town there were about 1000 cookers; and if every one of these were to be exchanged, they would be faced with an enormous capital expenditure. Manufacturers would need to put new boiling-rings into the cookers more cheaply than by supplying new cookers altogether. Mr. Dickson had remarked that they had too much control from London. This was a form of centralization which none of them liked. Centralization proper must be by areas. There was no reason why there should be three works of 200 millions within five miles of each other. There was some truth in the statement that the smaller works could produce as cheaply as the larger ones; but it required to be examined carefully. In the smaller works, everything was under the eye in a manner that was not possible in the larger undertakings.

Mr. John Richmond (Penicuik) considered there were great possibilities in fuel concentration and centralization. They had not reached the zenith in this respect. Centralization would certainly be a good thing; but the difficulty was to know how it was to be brought about. Coke had not been treated in the manner in which it should have been. If coal was selling at £1 per ton, coke should be about the same. Prices should not vary as much as they did. The new arrangement with the tar distillers was greatly to the credit of the distillers, and was evidence that they intended to work harmoniously with the producers. The agreement would ultimately be beneficial to both parties. The question of salaries was one which affected most of them, and should be gone into more thoroughly than in the past. Something tangible, he understood, was likely to accrue from the scale drawn up by the various Associations in England. This scale was submitted to the Committee of the Waverley Association and approved. But in this matter they put the cart before the horse. They found advertisements appearing for gas managers, and the following week an advertisement condemning the salaries, and suggesting that no application should be made on the terms offered. They should apply the scale in the first place, not to vacancies, but to the men who were in positions. If they got the scale applied to those who held appointments, they took away the incentive to apply for situations under the standard. Surely the present generation of gas managers were as worthy of consideration as the future generation.

Mr. Cowie said the Committee had during the year at one or two meetings very carefully considered the scale of salaries drawn up at Manchester; and it might be interesting to state that some of the principal resolutions were drafted by members of the Waverley Association. Their Association had adopted the scale; and it had been already in one or two cases put into practice. Any gas engineer who would like an increase of salary received a copy of the scale, and it was also sent to the chairman or secretary of the company. He mentioned this to show that the Committee had not lost sight of this important matter.

### Vote of Thanks.

A hearty vote of thanks was accorded to Mr. Bishop for his address, and the election of office-bearers was then proceeded with.

### Election of Office Bearers, &c.

The President moved that Mr. Robert Hamilton, of Dalkeith, be elected President for the ensuing year.

Mr. Black (Coldstream) seconded.

The motion was unanimously agreed to.

Mr. Hamilton, thanking the members for the honour, said he would do his best to maintain the high standard of the Association.

Mr. R. W. Cowie, who has been Hon. Secretary and Treasurer for seven years, intimated that, as he was now stationed in the west, and could not be in such close touch with the east as formerly, he regretted that he must resign the office.

Mr. Jas. D. Keillor, of Hawick, was appointed Secretary, and Mr. P. R. Chalmers, of Kelso, Mr. M'Donald, of Prestonpans, and Mr. James Gemmell, of Melrose, were appointed members of the Council. Mr. John M. O'Halloran was re-elected Auditor. Mr. Dickson, of Gorebridge, and Mr. Skee, of Jedburgh, were elected members, and Mr. Charles Ferns, of Nottingham, an extra-ordinary member.

**War Damage to Gas-Mains.**—M. Coze, the Director of the Verdun Gas-Works, has addressed to the Committee of the Société Technique an inquiry as to means of restoring a distribution system which has been submitted to heavy bombardments. The full reply of the Committee is not yet published, but two members suggested admitting to the mains compressed air with an admixture of sulphuretted hydrogen. The later, by its characteristic odour and its action on lead acetate, would readily enable the location of breakages to be detected.

## TOLUENE PRODUCTION IN THE UNITED STATES.

At a recent meeting of the Pennsylvania Gas Association, a survey was made of war activities in the course of a paper prepared by Captain H. E. Porter, of the U.S. Ordnance Section of the Officers Reserve Corps. It supplemented a paper read two years ago by Captain (now Colonel) Burns, on the relation of the coke and gas bye-products industry to military needs, which showed that absolute reliance must be placed on these industries as a source of explosive bases such as toluol and benzol, and that at least 17 million gallons of these substances would be required annually during the war, to provide explosives such as "T.N.T.," picric acid, amatol, and "T.N.X."

At the entrance of America into the war, the annual production of toluol was about 10 million gallons, of which 8 millions were exported. Even if the export was stopped, this would not cover national requirements. An additional production of 12 million gallons per annum was seen to be necessary; and this demand has been met. The additional supply of ammonia was provided, without serious shortage, by restrictions on its use as a fertilizer, and for peace manufacturing purposes; and though synthetic plants were in hand, they were not sufficiently advanced, before the signing of the armistice, to furnish substantial assistance. Benzol was produced in quantities adequate both for war purposes and the needs of the dye industry.

In eleven of the larger towns, at gas-works owned by the United Gas Improvement Company, the Pittsburg Bye-Product Coke Company, and the People's Gaslight and Coke Company of Chicago, plants having a rated capacity of 3,190,000 gallons per annum of pure toluol were either in actual operation or nearly completed. Sub-Committees on coal-tar bye-products and the recovery of toluol, connected with the Council of National Defence, took matters in hand in July, 1917, and speedily developed schemes and entered into negotiations with gas undertakings for new installations or for the enlargement of those in existence. Eighteen plants were got into operation at the larger works; and over the whole period of activity they averaged a production of 4½ million gallons per annum—speeded-up towards the time of closing to nearly 6 millions. They were shut-down at the signing of the armistice; and ten additional Government owned plants in progress were stopped. Construction was carried out under the control of the "Toluol Unit," Ordnance Department; and the total cost was over 1½ millions sterling.

A special feature was the re-enrichment of the stripped gas, with some of the benzol extracted from the light oils. Careful experiments showed an illuminating value of 27 candles, and a gain of 116 B.Th.U. per cubic foot per 1000 c.ft. per gallon of benzol. The average yield over the entire period averaged 0·0751 gallon of pure toluene per 1000 c.ft. of carburetted water gas, and 0·0693 gallon as a general average for all classes of gas. The actual yield of extract-oil was 1·904 gallons. The rate of circulation of wash-oil through the scrubbers averaged 10 gallons per 1000 c.ft. of gas treated; and the difference between the benzolized and debenzolized wash-oil was about 4 p.ct. of light oil. In the operation of fifteen army ordnance plants on water gas, using 3 to 4 gallons of gas oil per 1000 c.ft., an average of nearly 10 p.ct. was recovered as extracted oil, of which about one-fourth consisted of 90 p.ct. toluol; and by attention to temperatures and oil feed, toluol practically free from paraffins was obtained.

Drip and holder oils were also purchased by the Government, and worked for toluol—an average of 360,000 gallons per annum being thus obtained. Partial tar scrubbing at small gas-works was not adopted to any considerable extent, as all requirements were met by the larger installations at less expense.

## Southern Association Special Meeting.

It has been arranged that a special meeting of the members of the Southern District Association of Gas Engineers and Managers shall be held at the Old Kent Road works of the South Metropolitan Gas Company on Thursday, July 3. Members are asked to assemble as soon after 11.15 a.m. as possible, entering the works by the main-gate, adjacent to the gasholders. The day's proceedings at the works will commence at 11.30, and luncheon will be served at 1 o'clock in the Livesey Hall. At 2.30 p.m., the inspection of the works will be resumed; and at 4.15 p.m. tea will be served in the General Offices.

A Service will be held in Westminster Abbey to-morrow (Wednesday), at 12 noon, in memory of the members of the Professional Engineering Institutions who have fallen during the war. Places will be reserved in the Choir and Lantern for their relatives. The Service will be conducted by the Dean and the Precentor.

A visit is to be paid next Saturday by members of the Midland Junior Gas Association to the Stafford Corporation Gas and Electricity Works. At the gas offices they will be received by the Gas Engineer and Manager (Mr. W. M. Valon), and officially welcomed by the Chairman of the Committee (Alderman T. Westhead). During the inspection, they will be under the guidance of Mr. Valon, Mr. T. H. Poulson (his Chief Assistant, and President of the Association), Mr. J. Poulson (the Chemist), and Mr. W. H. Robins (the Electrical Engineer). Afterwards, at the invitation of the Gas Committee, the party will proceed to the Vine Hotel for tea.

# THE UTILIZATION OF GASEOUS FUEL IN COMMERCIAL PRACTICE.

## WITH CONSIDERATION OF THE TYPES OF GAS-FIRED FURNACES AND METHODS FOR THEIR CONTROL.

By F. W. EPWORTH, of the Richmond Gas Stove and Meter Company, Ltd., of Warrington.

**[The Essay that Won the Hadfield £100 Prize, Adjudicated upon by the Society of British Gas Industries.]**

Economy is the order of the day; and this is particularly the case with fuel. Gaseous fuel is at once the most convenient, and can be the most economical, method of heating. It is to be feared that there is much waste in the use of gaseous fuel, and that it is not always efficiently utilized. This arises largely from a lack of knowledge of the principles involved; and one of the objects of this paper is to set out the underlying principles which govern the control of gaseous fuels.

The gaseous fuels industrially employed for furnace work may be classified as follows:

(*a*) Town's gas.
(*b*) Water gas.
(*c*) Mond gas.
(*d*) Dry producer gas.
(*e*) Wet producer gas.

These various fuels contain one or more of the following combustible gases:

(*a*) Carbon monoxide, CO.
(*b*) Hydrogen, $H_2$.
(*c*) Methane (marsh gas), $CH_4$.
(*d*) Ethylene (olefiant gas), $C_2H_4$.

The combustible portion of the gas is always mixed with more or less of the non-combustible diluents, carbon dioxide ($CO_2$) and nitrogen ($N_2$).

The amount of heat evolved on combustion is an additive property, and can be calculated from the analysis of the gas and the calorific value of the pure gases. In furnace work the products of combustion leave the furnace at temperatures above 100° C., and the steam in the products is not condensed; so that the net calorific value of the pure gases must be employed in the calculation.

TABLE I.—*Net Calorific Values of Pure Gases.*

| Gas. | K.C.U. per Kilo. | B.Th.U. per Pound. | B.Th.U. per Cubic Foot. | K.C.U. per Cubic Foot. |
|---|---|---|---|---|
| $H_2$ . . . . | 29,130 | 52,425 | 294·2 | 74·14 |
| CO . . . . | 2,436 | 4,384 | 342 2 | 86·24 |
| $CH_4$ . . . | 11,976 | 21,555 | 970·0 | 244·45 |
| $C_2H_4$ . . . | 11,147 | 20,065 | 1595·0 | 402·00 |

Calculated from values given in "Kaye and Laby's Tables," 580 K.C.U. per kilo of steam produced has been deducted from the gross calorific values given there. From columns 2 and 3 in Table I., it would appear that hydrogen was a much better fuel than carbon monoxide. But this is not so. The figures are given in heat units per unit weight; and hydrogen [density cf. with air = ·06953] is so light that a large volume has very little weight; and therefore its effect on the calorific value of a gas is relatively small. Reference to columns 4 and 5 emphasizes this point. Hydrogen is the poorest fuel per unit volume of the four gases enumerated in the table.

These figures relate to the pure gases; and even could these be used on a commercial scale (for various reasons, some of which are discussed below), the whole of the available heat is not utilized.

### UNAVOIDABLE HEAT LOSSES.

(1) *Imperfect Combustion.*—This may arise from insufficient air supply, which may be intentional (*i.e.*, in open-flame annealing or the heat treatment of high-speed steel) or not. Flame contact with cold surfaces often leads to imperfect combustion.* Imperfect combustion is usually indicated by the presence of CO in the flue gases; sometimes in considerable amount.

(2) Heat conducted away by the body of the furnace and radiated into the air. The refractories used in furnace building vary greatly in their conductivity. Losses from this cause can be minimized by the use of low-conductivity bricks in the walls of the furnace, and by an exterior packing of some relatively non-conducting material, such as slag-wool or asbestos.

(3) *Radiation Losses.*—In some operations it is necessary to work with the door of the furnace open; and the amount of heat lost by radiation is serious in many cases. A recent example will indicate the extent of the loss which may result in an operation. A clay retort furnace was being heated by producer gas; the mouth of the retort being open. Although the temperature of the setting was 1150° C., it was found impossible to get the interior of the retort to any higher temperature than 900° C. On covering the mouth of the retort, the temperature within rapidly rose to a maximum of 1060° C.; indicating the enormous amount of heat which had been lost by radiation through the open door.

(4) Heat carried away by the products of combustion at the temperature at which they leave the furnace combustion chamber. This is a point which is often overlooked; and very few of those engaged in gas-furnace practice have any clear idea as to the magnitude of this factor. The influence of excess of air over and above that required for complete combustion on the heat carried away by the products is not generally realized.

In part, this has been due to lack of accurate knowledge of the specific heat of gases at high temperatures. The specific heat of gases increases with rising temperature. Table II. gives the mean specific heats of common gases used in these calculations:

TABLE II.

| Temperature. | $N_2$* | $CO_2$* | Steam.* | $O_2$† | Air. |
|---|---|---|---|---|---|
| 0° C.—100° C. . . | ·2369 | ·20824 | ·46566 | ·2150 | ·2320 |
| 200° C. . . | ·2388 | ·21512 | ·46530 | ·2170 | ·2335 |
| 300° C. . . | ·2407 | ·22164 | ·46582 | ·2186 | ·2357 |
| 400° C. . . | ·2426 | ·22780 | ·46722 | ·2205 | ·2375 |
| 500° C. . . | ·2445 | ·23360 | ·46950 | ·2224 | ·2394 |
| 600° C. . . | ·2464 | ·23904 | ·47266 | ·2243 | ·2412 |
| 700° C. . . | ·2483 | ·24412 | ·47670 | ·2263 | ·2433 |
| 800° C. . . | ·2502 | ·24884 | ·48162 | ·2282 | ·2450 |
| 900° C. . . | ·2521 | ·25340 | ·48742 | ·2301 | ·2470 |
| 1000° C. . . | ·2540 | ·25720 | ·49410 | ·2320 | ·2489 |
| 1100° C. . . | ·2559 | ·26084 | ·50166 | ·2339 | ·2509 |
| 1200° C. . . | ·2578 | ·26412 | 51010 | ·2358 | ·2528 |
| 1300° C. . . | ·2597 | ·26704 | ·51942 | ·2377 | ·2546 |
| 1400° C. . . | ·2616 | ·26960 | ·52962 | ·2395 | ·2565 |
| 1500° C. . . | ·2635 | ·27180 | ·54070 | ·2415 | ·2584 |
| 1600° C. . . | ·2654 | ·27364 | ·55206 | ·2434 | ·2604 |

* Holborn & Henning from Kaye & Laby's Tables, p. 58. Calculated by the Author.
† From "Industrial Furnaces," E. Damour. Translated by A. J. L. Queneau.

The composition of the typical gases used in these calculations was as follows:

(1) Dry producer gas (theoretical gas).
(2) Steam-jet producer gas.
(3) Water gas (Dellwik-Fleischer, average composition).
(4) Mond gas (average sample).
(5) Town's gas of approximately 500 B.Th.U. gross.

TABLE III.

*Composition by Volume.*

| Gas. | CO. | $H_2$. | $CH_4$. | $C_2H_4$. | $N_2$. | $CO_2$. | Total. |
|---|---|---|---|---|---|---|---|
| 1 | 34·33 | .. | .. | .. | 65·66 | .. | 100·0 |
| 2 | 23·0 | 14·0 | 2·2 | .. | 56·8 | 4·0 | 100·0 |
| 3 | 42·0 | 51·0 | 0 5 | .. | 2·5 | 4·0 | 100·0 |
| 4 | 11·0 | 27·0 | 2 0 | .. | 43·0 | 17·0 | 100·0 |
| 5 | 17·0 | 41·0 | 24·0 | 3·0 | 12·0 | 3·0 | 100·0 |

The calorific values of the above gases, together with the volume and weight of oxygen and air required for complete combustion, are set out in Tables V. and VI.

Table VII. shows the composition by volume and by weight of the products of the complete combustion of the gases in oxygen; and Table VIII., the products when air is used.

In Tables IX. to XVI. the amount of heat contained in the products of combustion is expressed as a percentage of the available net calorific value. The values have been calculated under five sets of conditions:

(*a*) Combustion in the theoretical amount of oxygen.
(*b*) " the theoretical amount of air.
(*c*) " excess air (excess air = one volume of fuel gas).
(*d*) " excess air (excess air = two volumes of fuel gas).
(*e*) " excess air (excess air = three volumes of fuel gas).

A careful study of Tables XII. to XVI. will reveal the reason why it is necessary to make use of the heat contained in the products for the purpose of preheating the air used for combustion. It is practically impossible to attain a high temperature with producer gas (either dry or wet) or with Mond gas, unless preheating is adopted.

Town gas and water gas yield temperatures up to 1400° C. or over without preheating, provided the air supply is properly controlled. Reference to Table XVI. will show that with products leaving at 1400° C. (combustion in air) 61·6 p.ct. of the total available heat is contained in the flue products. This could be largely recovered by the preheating principle.

* Siemens's contention, "Keep flame from surfaces to ensure efficient combustion" is erroneous. *Vide* Chapter on Surface Combustion in "Coal and Its Scientific Uses," 1918, by Bone.

TABLE IV.—*Composition by Weight.*

| Gas. | CO. | $H_2$. | $CH_4$. | $C_2H_4$. | $N_2$. | $CO_2$. | Total. |
|---|---|---|---|---|---|---|---|
| 1 | ·3433 | .. | .. | .. | ·6566 | .. | 1·000 |
| 2 | ·2601 | ·0114 | ·0144 | .. | ·6425 | ·0716 | 1·000 |
| 3 | ·7667 | ·0669 | ·0053 | .. | ·0457 | ·1154 | 1·000 |
| 4 | ·1309 | ·0231 | ·0137 | .. | ·5122 | ·3201 | 1·000 |
| 5 | ·3173 | ·0550 | ·2582 | ·0570 | ·2240 | ·0885 | 1·000 |

TABLE V.—*Calorific Powers of the Typical Gases.*

| Gas. | K.C.U. per Kilo. | | Gross, per C.Ft. | | Net, per C.Ft. | |
|---|---|---|---|---|---|---|
| | Gross. | Net. | K.C.U. | B.Th.U. | K.C.U. | B.Th.U. |
| 1 | 836·3 | — | 29 63 | 117·6 | — | — |
| 2 | 1216·4 | 1138·0 | 38·06 | 151·0 | 35·60 | 141·3 |
| 3 | 4236·1 | 3880·0 | 82·15 | 326·0 | 75·25 | 298 6 |
| 4 | 1294·4 | 1155·9 | 38·50 | 152·8 | 34·39 | 136·5 |
| 5 | 6769·6 | 6103·0 | 128·3 | 509·3 | 115 8 | 459·4 |

TABLE VI.—*Weight and Volume of Oxygen and Air, required for Complete Combustion of Typical and Pure Gases.*

| Gas. | Weight of | | Nitrogen Brought in by Air. | Volume of | | Nitrogen Brought in by Air. |
|---|---|---|---|---|---|---|
| | Oxygen. | Air. | | Oxygen. | Air. | |
| 1 | ·1961 | ·8526 | ·6565 | ·1716 | ·8283 | ·6566 |
| 2 | ·2974 | 1·2903 | ·9956 | ·229 | 1·105 | ·876 |
| 3 | ·9945 | 4·3217 | 3·3272 | ·475 | 2·293 | 1·818 |
| 4 | ·3144 | 1·3671 | 1·0527 | ·230 | 1·110 | ·880 |
| 5 | 1·8497 | 8·0422 | 6·1925 | ·860 | 4·151 | 3·291 |
| CO | 571 | 2·483 | 1·912 | ·500 | 2·40 | 1·90 |
| $H_2$ | 8 000 | 34·783 | 26·783 | ·500 | 2·40 | 1·90 |
| $CH_4$ | 4·000 | 17·391 | 13·391 | 2·000 | 9 60 | 7·60 |
| $C_2H_4$ | 3·429 | 14·91 | 11·481 | 3·000 | 14·40 | 11·40 |

TABLE VII.—*Complete Combustion in $O_2$.*

| Gas. | Products from Unit Weight. | | | Products* from Unit Volume. | |
|---|---|---|---|---|---|
| | $CO_2$. | Steam. | $N_2$. | $CO_2$. | $N_2$. |
| 1 | ·5395 | — | ·6566 | ·3433 | ·6566 |
| 2 | ·5198 | ·1350 | ·6425 | ·292 | ·568 |
| 3 | 1·3348 | ·6140 | ·0457 | ·465 | ·025 |
| 4 | ·5635 | ·2387 | ·5122 | ·30 | ·43 |
| 5 | 1·4764 | 1 1493 | ·2240 | ·50 | ·12 |
| CO | 1·571 | — | — | 1 00 | — |
| $H_2$ | — | 9·000 | — | — | — |
| $CH_4$ | 2·750 | 2·250 | — | 1·00 | — |
| $C_2H_4$ | 3·143 | 1·286 | — | 2·00 | — |

* Products assumed to be cold—*i.e.*, steam condensed.

TABLE VIII.—*Complete Combustion in Air.*

| Gas. | Products from Unit Weight. | | | Products* from Unit Volume. | |
|---|---|---|---|---|---|
| | $CO_2$. | Steam. | $N_2$ | $CO_2$. | $N_2$. |
| 1 | ·5395 | — | 1·3131 | ·3433 | 1·3133 |
| 2 | ·5198 | ·1350 | 1·6381 | ·292 | 1·444 |
| 3 | 1 3348 | ·6140 | 3·3729 | ·465 | 1·843 |
| 4 | ·5635 | ·2387 | 1·5649 | ·30 | 1·31 |
| 5 | 1·4764 | 1·1493 | 6·4165 | ·50 | 3·411 |
| CO | 1·571 | — | 1·912 | 1·00 | 1·90 |
| $H_2$ | — | 9·000 | 26·783 | — | 1·90 |
| $CH_4$ | 2·750 | 2·250 | 13·391 | 1·00 | 7·60 |
| $C_2H_4$ | 3·143 | 1·286 | 11·480 | 2·00 | 11·40 |

* Products assumed to be cold—*i.e.*, steam condensed.

TABLE IX.—*Hydrogen.*

| Products Leaving at | $O_2$. | Air. | Excess Air (1). | Excess Air (2). | Excess Air (3). |
|---|---|---|---|---|---|
| ° C. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. |
| 100 | 1·44 | 3·62 | 4·77 | 5·91 | 7·05 |
| 200 | 2·88 | 7·27 | 9·57 | 11·88 | 14·19 |
| 300 | 4·32 | 10·95 | 14·44 | 17·93 | 21·42 |
| 400 | 5·78 | 14·69 | 19·38 | 24·07 | 28·76 |
| 500 | 7·26 | 18·49 | 24·40 | 30·31 | 37·07 |
| 600 | 8·76 | 22·36 | 29·50 | 36·66 | 43·77 |
| 700 | 10·30 | 26·29 | 34·68 | 43·08 | 51·50 |
| 800 | 11·91 | 30·27 | 40·00 | 50·83 | 59·33 |
| 900 | 13·55 | 34 42 | 45·38 | 56·35 | 67·33 |
| 1000 | 15·27 | 38·61 | 50·91 | 63·19 | 75·48 |
| 1100 | 17·05 | 42·92 | 56·54 | 70·17 | 83·81 |
| 1200 | 18·91 | 47·37 | 62·33 | 77·31 | 92·96 |
| 1300 | 20·86 | 51·90 | 68·25 | 84·55 | 100·9 |
| 1400 | 22·92 | 56·57 | 74·30 | 92·02 | 109·7 |

1 vol. of excess air would give 7·12 per cent. $O_2$ in products at N.T.P.
2 vols. ,, ,, ,, 10·59 ,, ,, ,, ,, ,,
3 vols. ,, ,, ,, 12·60 ,, ,, ,, ,, ,,

TABLE X.—*Carbon Monoxide.*

| Products Leaving at | Combustion in Oxygen. | Air. | 1 Vol. Excess Air. | 2 Vols. | 3 Vols. |
|---|---|---|---|---|---|
| ° C. | Per Cent. | Per Cent | Per Cent. | Per Cent. | Per Cent. |
| 100 | 1·34 | 3·20 | 4·18 | 5·17 | 6·16 |
| 200 | 2·77 | 6·53 | 8·51 | 10·49 | 12·47 |
| 300 | 4·29 | 9·95 | 12·95 | 15·95 | 18·95 |
| 400 | 5·88 | 13·49 | 17·52 | 21·55 | 25·58 |
| 500 | 7 53 | 17·12 | 22·20 | 27·29 | 32 37 |
| 600 | 9 25 | 20·84 | 27·01 | 33 15 | 39·29 |
| 700 | 11·02 | 24·65 | 31·88 | 39·10 | 46·31 |
| 800 | 12·84 | 28·54 | 36·87 | 45·20 | 53·51 |
| 900 | 14·71 | 32·51 | 41·96 | 51·40 | 60·82 |
| 1000 | 16·58 | 36·51 | 47·08 | 57·62 | 68·21 |
| 1100 | 18·50 | 40·60 | 52·31 | 64·01 | 75·73 |
| 1200 | 20·44 | 44·72 | 57·58 | 70·46 | 83·33 |
| 1300 | 22·40 | 48·89 | 62·92 | 76·96 | 91·03 |
| 1400 | 24·34 | 53 08 | 68·31 | 83·56 | 98·79 |

Combustion in air gives 34·34 p.ct. $CO_2$ in products.
,, 1 vol. excess air 25·56 p.ct. $CO_2$ and 5·3 p.ct. $O_2$ in products.
,, 2 vols. ,, 20·35 p.ct. $CO_2$ and 8·43 p.ct. $O_2$ ,,
,, 3 vols. ,, 16·95 p.ct. $CO_2$ and 10·2 p.ct. $O_2$ ,,

TABLE XI.—*Marsh Gas (Methane).*

| Products Leaving at | Combustion in Oxygen. | Air. | 1 Vol. Excess. | 2 Vols. | 3 Vols. |
|---|---|---|---|---|---|
| ° C. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. |
| 100 | 1·35 | 4 00 | 4·35 | 4·70 | 5·04 |
| 200 | 2·74 | 8 08 | 8 78 | 9·48 | 10·17 |
| 300 | 4·16 | 12·23 | 13·28 | 14·34 | 15·40 |
| 400 | 5·60 | 16 43 | 17·86 | 19·30 | 20·71 |
| 500 | 7·09 | 20·76 | 22·55 | 24·34 | 26·13 |
| 600 | 8·62 | 25·15 | 27·32 | 29·48 | 31 65 |
| 700 | 10·20 | 29·63 | 32·18 | 34·71 | 37·27 |
| 800 | 11·81 | 34·19 | 37·14 | 40·05 | 43·00 |
| 900 | 13·48 | 38·86 | 42·18 | 45·51 | 48·83 |
| 1000 | 15·19 | 43·59 | 47·32 | 51 04 | 54·76 |
| 1100 | 16·95 | 48·43 | 52·57 | 56·70 | 60·82 |
| 1200 | 18·77 | 53·37 | 57·90 | 62 44 | 68·57 |
| 1300 | 20·65 | 58·39 | 63·37 | 68·17 | 73·26 |
| 1400 | 22·69 | 63 65 | 69·01 | 74·39 | 79·77 |

Combustion in air gives 11·55 p.ct. $CO_2$ in cold products.
,, 1 vol. excess air 10·36 p.ct. $CO_2$ and 2·15 p.ct. $O_2$ in products.
,, 2 vols. ,, 9·39 p.ct. $CO_2$ and 3·89 p.ct. $O_2$ ,,
,, 3 vols. ,, 8·62 p.ct. $CO_2$ and 4·95 p.ct. $O_2$ ,,

TABLE XII.—*Dry Producer Gas.*

| Products Leaving at | Combustion in Oxygen. | Air. | 1 Vol. Excess. | 2 Vols. | 3 Vols. |
|---|---|---|---|---|---|
| ° C. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. |
| 100 | 3·20 | 5·07 | 7·94 | 10·91 | 13·68 |
| 200 | 6·53 | 10·28 | 16·06 | 21·83 | 27·61 |
| 300 | 9 95 | 15·63 | 24·37 | 33 11 | 41·85 |
| 400 | 13·38 | 20·99 | 32·74 | 44·47 | 56·22 |
| 500 | 17·12 | 26·59 | 41 50 | 56·28 | 71·09 |
| 600 | 20·84 | 32·45 | 50·36 | 68·26 | 86·18 |
| 700 | 24 67 | 38·29 | 59·36 | 80·41 | 101·4 |
| 800 | 28·56 | 44·26 | 68·50 | 92·72 | 119·7 |
| 900 | 32·61 | 50·30 | 77·78 | 105·3 | 132·7 |
| 1000 | 36·53 | 56·45 | 87·22 | 118·0 | 148·7 |
| 1100 | 40·61 | 62·69 | 96·81 | 130·9 | 165·0 |
| 1200 | 44·74 | 69·04 | 106·5 | 144·0 | 181·4 |
| 1300 | 48·91 | 75·41 | 116·3 | 157·2 | 198·2 |
| 1400 | 53 09 | 81·85 | 126·2 | 170·6 | 215·0 |

Combustion in air gives 20·72 p.ct. $CO_2$ in cold products.
,, 1 vol. excess air 12·92 p.ct. $CO_2$ and 7·80 p.ct. $O_2$ in products.
,, 2 vols. ,, 9·39 p.ct. $CO_2$ and 11·33 p.ct. $O_2$ ,,
,, 3 vols. ,, 7·37 p.ct. $CO_2$ and 13·35 p.ct. $O_2$ ,,

TABLE XIII.—*Steam Jet Producer Gas.*

| Products Leaving at | Combustion in Oxygen. | Air. | 1 Vol. Excess. | 2 Vols. | 3 Vols. |
|---|---|---|---|---|---|
| ° C. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. |
| 100 | 2·84 | 4·91 | 7·30 | 9·68 | 12·06 |
| 200 | 5·78 | 9·95 | 14·76 | 19·55 | 24·35 |
| 300 | 8·78 | 15·10 | 22·37 | 29·63 | 36·90 |
| 400 | 11·85 | 20·34 | 30·11 | 39·87 | 49·64 |
| 500 | 15·02 | 25·71 | 38·02 | 50·32 | 62·59 |
| 600 | 18·27 | 31·20 | 46·09 | 60·98 | 75·90 |
| 700 | 21·57 | 36 77 | 54·28 | 71·76 | 89·28 |
| 800 | 24·96 | 42·46 | 62·62 | 82·77 | 102·9 |
| 900 | 28·43 | 48·28 | 71·12 | 93·97 | 116 8 |
| 1000 | 31·94 | 54·17 | 79 75 | 105·3 | 130·9 |
| 1100 | 35·54 | 60·17 | 88·53 | 116·9 | 145·2 |
| 1200 | 39·20 | 66·28 | 97·43 | 128·6 | 159·8 |
| 1300 | 42·92 | 72·43 | 106·4 | 140·6 | 174·5 |
| 1400 | 46·72 | 78·75 | 115·6 | 152·5 | 189·4 |

Combustion in air gives 16·82 p.ct. $CO_2$ in cold products.
,, 1 vol. excess air 10·68 p.ct. $CO_2$ and 7·57 p.ct. $O_2$ in products.
,, 2 vols. ,, 7·82 p.ct. $CO_2$ and 11·09 p.ct. $O_2$ ,,
,, 3 vols. ,, 6·17 p.ct. $CO_2$ and 13·12 p.ct. $O_2$ ,,

TABLE XIV.—*Water Gas.*

| Products Leaving at | Combustion in Oxygen. | Air. | 1 Vol. Excess. | 2 Vols. | 3 Vols. |
|---|---|---|---|---|---|
| ° C. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. |
| 100 | 1·46 | 3·49 | 4·62 | 5·75 | 6·88 |
| 200 | 3·01 | 7·11 | 9·38 | 11·65 | 13·93 |
| 300 | 4·59 | 10·77 | 14·22 | 17·66 | 21·11 |
| 400 | 6·20 | 14·52 | 19·14 | 23·77 | 28·40 |
| 500 | 7·88 | 18·35 | 24·18 | 30·01 | 35·83 |
| 600 | 9·60 | 22·27 | 29·32 | 36·38 | 43·43 |
| 700 | 11·49 | 26·39 | 34·68 | 42·96 | 51·26 |
| 800 | 13·18 | 30·35 | 39·88 | 49·43 | 58·98 |
| 900 | 15·06 | 34·52 | 45·33 | 56·16 | 66·99 |
| 1000 | 16·96 | 38·74 | 50·87 | 62·96 | 75·09 |
| 1100 | 18·93 | 43·07 | 56·49 | 69·95 | 83·37 |
| 1200 | 20·96 | 47·47 | 62·24 | 77·00 | 91·75 |
| 1300 | 23·08 | 51·98 | 68·08 | 84·18 | 100·3 |
| 1400 | 25·15 | 56·53 | 74·03 | 91·49 | 109·0 |

Combustion in air gives 20·15 p.c. $CO_2$ in cold products.
" 1 vol. excess air 14·06 p.c. $CO_2$ and 6·26 p.c. $O_2$ in products.
" 2 vols. " 10·79 p.c. $CO_2$ and 9 62 p.c. $O_2$ "
" 3 vols. " 8·76 p.c. $CO_2$ and 11·71 p.c. $O_2$ "

TABLE XV.—*Mond Gas.*

| Products Leaving at | Combustion in Oxygen. | Air. | 1 Vol. Excess. | 2 Vols. | 3 Vols. |
|---|---|---|---|---|---|
| ° C. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. |
| 100 | 3·02 | 5·18 | 7·48 | 10·13 | 12·60 |
| 200 | 6·16 | 10·51 | 15·48 | 20·46 | 25·43 |
| 300 | 9·33 | 15·91 | 23·43 | 30·96 | 38·49 |
| 400 | 12·60 | 21·42 | 31·54 | 41·64 | 51·75 |
| 500 | 15·95 | 27·07 | 39·82 | 52·55 | 65·30 |
| 600 | 19·39 | 32·85 | 48·27 | 63·69 | 79·11 |
| 700 | 22·92 | 38·75 | 56·87 | 74·99 | 93·11 |
| 800 | 26·53 | 44·75 | 65·64 | 86·52 | 107·4 |
| 900 | 30·29 | 51·10 | 74·76 | 98·42 | 122·1 |
| 1000 | 33·99 | 57·12 | 83·64 | 110·1 | 136·7 |
| 1100 | 37·85 | 63·48 | 92·85 | 122·3 | 151·6 |
| 1200 | 41·79 | 69·97 | 102·3 | 134·6 | 166·8 |
| 1300 | 45·83 | 76·56 | 111 8 | 147·0 | 182·3 |
| 1400 | 49·94 | 83 28 | 121·4 | 159·7 | 197·9 |

Combustion in air gives 18·63 p.c. $CO_2$ in cold products.
" 1 vol. excess air 11 49 p.c. $CO_2$ and 7·94 p.c. $O_2$ in products.
" 2 vols. " 8·31 p.c. $CO_2$ and 11·48 p.c. $O_2$ "
" 3 vols. " 6·51 p.c. $CO_2$ and 13·48 p.c. $O_2$ "

TABLE XVI.—*Town's Gas.*

| Products Leaving at | Combustion in Oxygen. | Air. | 1 Vol. Excess. | 2 Vols. | 3 Vols. |
|---|---|---|---|---|---|
| ° C. | Per Cent. | Per Cent. | Per Cent. | Per Cent. | Per Cent. |
| 100 | 1·47 | 3·87 | 4·61 | 5·34 | 6·07 |
| 200 | 2·97 | 7·82 | 9·30 | 10·77 | 12·25 |
| 300 | 4·52 | 11·84 | 14·07 | 16·30 | 18·54 |
| 400 | 6·08 | 15·93 | 18·83 | 21·93 | 24·94 |
| 500 | 7·70 | 20·10 | 23·83 | 27·67 | 31·45 |
| 600 | 9·35 | 24·35 | 28·93 | 33·43 | 38·02 |
| 700 | 11·05 | 28·69 | 34·07 | 39·46 | 44·84 |
| 800 | 12·81 | 33·14 | 39·33 | 45·53 | 51·72 |
| 900 | 14·61 | 37·56 | 44·68 | 51·70 | 58·72 |
| 1000 | 16·46 | 42·32 | 50·12 | 57 98 | 65·84 |
| 1100 | 18·36 | 46·98 | 55·68 | 64·42 | 73·13 |
| 1200 | 20·29 | 51·74 | 61·32 | 70·90 | 80·48 |
| 1300 | 22·35 | 56·60 | 67·06 | 77·54 | 88·00 |
| 1400 | 24·44 | 61·60 | 72·96 | 84 32 | 95·68 |

Combustion in air gives 12·78 p.c. $CO_2$ in cold products.
" 1 vol. excess air 10·16 p.c. $CO_2$ and 4·22 p.c. $O_2$ in products.
" 2 vols. " 8·46 p.c. $CO_2$ and 7·01 p.c. $O_2$ "
" 3 vols. " 7·24 p.c. $CO_2$ and 8·99 p.c. $O_2$ "

The influence of excess air, over and above that required for complete combustion, on the amount of heat carried off by the products is well shown in the tables. The poorer the gas, the greater the amount of heat taken out by the products relative to the total amount of heat produced in the combustion.

Excess air has another disadvantage, in that it depresses the flame temperature—see Tables XVII. to XXI.

It has been customary to compare the relative heating efficiency of fuels by calculating their theoretical flame temperature or calorific intensity. This is calculated from the formula:

$$\text{Calorific Intensity} = \frac{\text{Net Calorific Value}}{\text{Sum of Specific Heat of Products}}$$

The heat units used in the equation must be the same throughout; and the result will be expressed in °F. or °C., according to the units adopted.

The temperatures in Tables XVII. to XXI. are very much higher than those obtained by actual combustion; and they are

*Theoretical Calorific Intensities of the Five Typical Industrial Gaseous Fuels.*

TABLE XVII.—*Calorific Intensity of Dry Producer Gas.*

(*A*) Combustion in Oxygen (Theoretical Amount).

| Gas Temperature. | Temperature of Oxygen Entering Furnace. 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000 C. |
|---|---|---|---|---|---|---|
| 0° C. | 2598 | 2627 | 2652 | 2680 | 2708 | 2739 |
| 500° C. | 2984 | 3012 | 3038 | 3066 | 3093 | 3125 |
| 1000° C. | 3397 | 3427 | 3451 | 3479 | 3506 | 3538 |
| 1200° C. | 3576 | 3606 | 3631 | 3659 | 3687 | 3718 |

(*B*) Combustion in Air (Theoretical Amount).

| Temperature of Gas Entering Furnace. | Temperature of Air Entering Furnace. 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
|---|---|---|---|---|---|---|
| 0° C. | 1686 | 1768 | 1849 | 1935 | 2022 | 2113 |
| 500° C. | 1936 | 2018 | 2099 | 2184 | 2272 | 2363 |
| 1000° C. | 2204 | 2287 | 2368 | 2452 | 2541 | 2631 |
| 1200° C. | 2320 | 2402 | 2483 | 2568 | 2657 | 2748 |

(*C*) Combustion in Excess Air (1 Vol. of Excess Air).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
|---|---|---|---|---|---|---|
| 0° C. | 1092 | 1210 | 1326 | 1449 | 1575 | 1706 |
| 500° C. | 1254 | 1372 | 1488 | 1611 | 1737 | 1868 |
| 1000° C. | 1429 | 1546 | 1663 | 1785 | 1912 | 2042 |
| 1200° C. | 1504 | 1621 | 1738 | 1861 | 1986 | 2117 |

(*D*) Combustion in Excess Air (2 Vols. of Excess Air).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
|---|---|---|---|---|---|---|
| 0° C. | 808 | 943 | 1076 | 1216 | 1360 | 1510 |
| 500° C. | 928 | 1063 | 1196 | 1337 | 1480 | 1630 |
| 1000° C. | 1057 | 1191 | 1324 | 1465 | 1609 | 1760 |
| 1200° C. | 1113 | 1248 | 1380 | 1521 | 1664 | 1815 |

(*E*) Combustion in Excess Air (3 Vols. of Excess Air).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
|---|---|---|---|---|---|---|
| 0° C. | 642 | 786 | 929 | 1080 | 1235 | 1396 |
| 500° C. | 736 | 881 | 1024 | 1175 | 1330 | 1491 |
| 1000° C. | 839 | 984 | 1126 | 1277 | 1432 | 1593 |
| 1200° C. | 883 | 1028 | 1170 | 1321 | 1476 | 1638 |

entirely theoretical temperatures. For this, there are several reasons, some of which will be indicated briefly:

(1) Combustion is supposed to be instantaneous; and this is not realized in practice.

(2) The specific heat of the products rises rapidly with rising temperature; and the specific heats at temperatures over 1600° C. are not accurately known.

(3) No allowance is made for the heat given out as radiant heat. The results of R. von Helmholtz (quoted by Prof. W. A. Bone in "Coal and its Scientific Uses") show that:

A hydrogen flame radiates 3 p.ct. of its total heat of combustion.

A coal gas flame radiates 5 p.ct. of its total heat of combustion.

A carbon monoxide flame radiates 8 p.ct. of its total heat of combustion.

Thus a gas containing a large percentage of CO will lose much heat by radiation.

(4) At high temperatures, both $CO_2$ and steam tend to dissociate into CO and $O_2$ and $H_2$ and $O_2$ respectively; and some of the heat of combustion is dissipated by this dissociation.

These and other factors tend to lower the flame temperature below that theoretically possible. Tables XVII. to XXI. bring out very clearly the influence of an excess of air on the flame temperature; and they also show the advantage to be gained by preheating the gas and air before allowing combustion to take place.

It is well known among practical men that CO is better for furnace work than hydrogen. This is probably due to the higher radiating power of a CO flame compared with the hydrogen flame, since the work will be heated by the heat radiated from the flame itself.

TABLE XVIII.—*Calorific Intensity of Wet Producer Gas.*

(*A*) Combustion in Oxygen (Theoretical Amount).

| Temperature of Gas Entering Furnace. | Temperature of Oxygen Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 2939 | 2975 | 3007 | 3042 | 3077 | 3116 |
| 500° C. | 3315 | 3353 | 3383 | 3418 | 3453 | 3493 |
| 1000° C. | 3731 | 3767 | 3798 | 3834 | 3870 | 3908 |
| 1200° C. | 3909 | 3946 | 3977 | 4013 | 4049 | 4088 |

(*B*) Combustion in Air (Theoretical Amount).

| Temperature of Gas Entering Furnace. | Temperature of Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 1747 | 1842 | 1935 | 2033 | 2135 | 2241 |
| 500° C. | 1971 | 2065 | 2159 | 2257 | 2359 | 2469 |
| 1000° C. | 2218 | 2312 | 2406 | 2504 | 2606 | 2711 |
| 1200° C. | 2324 | 2418 | 2513 | 2610 | 2713 | 2818 |

(*C*) Combustion in Excess Air (1 Vol.).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 1190 | 1313 | 1434 | 1563 | 1693 | 1831 |
| 500° C. | 1343 | 1465 | 1587 | 1715 | 1847 | 1984 |
| 1000° C. | 1511 | 1633 | 1755 | 1883 | 2015 | 2152 |
| 1200° C. | 1583 | 1706 | 1828 | 1955 | 2087 | 2224 |

(*D*) Combustion in Excess Air (2 Vols.).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 902 | 1040 | 1176 | 1319 | 1467 | 1619 |
| 500° C. | 1018 | 1155 | 1291 | 1434 | 1582 | 1736 |
| 1000° C. | 1146 | 1283 | 1419 | 1563 | 1709 | 1863 |
| 1200° C. | 1200 | 1339 | 1474 | 1617 | 1765 | 1918 |

(*E*) Combustion in Excess Air (3 Vols.).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 727 | 873 | 1018 | 1170 | 1327 | 1490 |
| 500° C. | 820 | 966 | 1111 | 1264 | 1421 | 1583 |
| 1000° C. | 923 | 1069 | 1214 | 1367 | 1523 | 1686 |
| 1200° C. | 967 | 1113 | 1258 | 1410 | 1568 | 1731 |

TABLE XIX.—*Calorific Intensity of Water Gas.*

(*A*) Combustion in Oxygen (Theoretical Amount).

| Temperature of Gas Entering Furnace. | Temperature of Oxygen Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 5414 | 5480 | 5538 | 5599 | 5665 | 5736 |
| 500° C. | 5744 | 5811 | 5865 | 5930 | 5996 | 6067 |
| 1000° C. | 6106 | 6172 | 6229 | 6294 | 6357 | 6430 |
| 1200° C. | 6266 | 6333 | 6389 | 6452 | 6518 | 6589 |

(*B*) Combustion in Air (Theoretical Amount).

| Temperature of Gas Entering Furnace. | Temperature of Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 2425 | 2555 | 2682 | 2816 | 2954 | 3098 |
| 500° C. | 2573 | 2703 | 2830 | 2965 | 3103 | 3247 |
| 1000° C. | 2736 | 2865 | 2992 | 3127 | 3265 | 3409 |
| 1200° C. | 2807 | 2937 | 3064 | 3199 | 3336 | 3480 |

(*C*) Combustion in Excess Air (1 Vol.).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 1856 | 1996 | 2137 | 2284 | 2436 | 2595 |
| 500° C. | 1968 | 2110 | 2251 | 2397 | 2550 | 2708 |
| 1000° C. | 2092 | 2235 | 2374 | 2523 | 2674 | 2831 |
| 1200° C. | 2147 | 2289 | 2430 | 2577 | 2729 | 2886 |

(*D*) Combustion in Excess Air (2 Vols.).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 1502 | 1651 | 1799 | 1955 | 2115 | 2282 |
| 500° C. | 1593 | 1743 | 1891 | 2046 | 2208 | 2374 |
| 1000° C. | 1693 | 1844 | 1992 | 2147 | 2308 | 2474 |
| 1200° C. | 1738 | 1888 | 2036 | 2192 | 2352 | 2519 |

(*E*) Combustion in Excess Air (3 Vols.).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 1262 | 1417 | 1570 | 1732 | 1898 | 2070 |
| 500° C. | 1339 | 1494 | 1647 | 1809 | 1975 | 2147 |
| 1000° C. | 1423 | 1578 | 1731 | 1893 | 2059 | 2231 |
| 1200° C. | 1460 | 1615 | 1769 | 1931 | 2097 | 2269 |

RELATIVE ADVANTAGE OF PREHEATING THE GAS AND THE AIR.

From the tables given, it would appear, generally, that preheating the air to 200° C. has the same effect on the calorific intensity as preheating the gas to 500° C.; and it would appear to be more advantageous to preheat the air rather than the gas. It is more convenient to preheat the air than to preheat the gas, for the following reasons:

(1) Heating the gas to a high temperature tends to decompose any hydrocarbon gases which may be present in it, and thus reduce the actual calorific power of the gas.

(2) The reaction $CO + H_2O \rightleftharpoons CO_2 + H_2$ is reversible; and, on heating, the reaction will proceed in one direction or the other until $\frac{C_{co} \times C_{oh2}}{C_{co2} \times C_{h2}} = K$. The value of K depends on the temperature.

TABLE XX.—*Calorific Intensity of Mond Gas.*

(*A*) Combustion in Oxygen (Theoretical Amount).

| Temperature of Gas Entering Furnace. | Temperature of Oxygen Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 2739 | 2774 | 2805 | 2839 | 2871 | 2912 |
| 500° C. | 3125 | 3161 | 3191 | 3225 | 3258 | 3298 |
| 1000° C. | 3559 | 3594 | 3625 | 3659 | 3700 | 3732 |
| 1200° C. | 3747 | 3782 | 3813 | 3847 | 3887 | 3919 |

(*B*) Combustion in Air (Theoretical Amount).

| Temperature of Gas Entering Furnace. | Temperature of Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 1648 | 1741 | 1833 | 1931 | 2030 | 2134 |
| 500° C. | 1880 | 1973 | 2065 | 2163 | 2263 | 2366 |
| 1000° C. | 2142 | 2235 | 2326 | 2424 | 2523 | 2626 |
| 1200° C. | 2255 | 2347 | 2438 | 2536 | 2636 | 2739 |

(*C*) Combustion in Excess Air (1 Vol.).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 1131 | 1252 | 1369 | 1495 | 1629 | 1764 |
| 500° C. | 1290 | 1411 | 1528 | 1654 | 1787 | 1923 |
| 1000° C. | 1470 | 1591 | 1708 | 1834 | 1967 | 2102 |
| 1200° C. | 1547 | 1667 | 1784 | 1910 | 2044 | 2178 |

(*D*) Combustion in Excess Air (2 Vols.).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 861 | 987 | 1132 | 1274 | 1419 | 1570 |
| 500° C. | 982 | 1187 | 1254 | 1396 | 1540 | 1692 |
| 1000° C. | 1119 | 1254 | 1390 | 1532 | 1677 | 1828 |
| 1200° C. | 1178 | 1313 | 1448 | 1590 | 1736 | 1887 |

(*E*) Combustion in Excess Air (3 Vols.).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. | 695 | 841 | 984 | 1135 | 1290 | 1452 |
| 500° C. | 793 | 938 | 1082 | 1233 | 1389 | 1550 |
| 1000° C. | 903 | 1047 | 1191 | 1342 | 1498 | 1660 |
| 1200° C. | 951 | 1095 | 1239 | 1391 | 1545 | 1708 |

TABLE XXI.—*Calorific Intensity of Towns Gas.*

(*A*) Combustion in Oxygen (Theoretical Amount).

| Temperature of Gas Entering Furnace. | Temperature of Oxygen Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. . . . . | 5555 | 5635 | 5705 | 5782 | 5860 | 5946 |
| 500° C. . . . . | 5820 | 5899 | 5969 | 6046 | 6124 | 6210 |
| 1000° C. . . . . | 6144 | 6222 | 6292 | 6369 | 6447 | 6533 |
| 1200° C. . . . . | 6290 | 6369 | 6439 | 6516 | 6594 | 6680 |

(*B*) Combustion in Air (Theoretical Amount).

| Temperature of Gas Entering Furnace. | Temperature of Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. . . . . | 2225 | 2365 | 2503 | 2650 | 2800 | 2956 |
| 500° C. . . . . | 2331 | 2471 | 2609 | 2756 | 2906 | 3062 |
| 1000° C. . . . . | 2460 | 2599 | 2737 | 2884 | 3033 | 3190 |
| 1200° C. . . . . | 2520 | 2659 | 2797 | 2944 | 3093 | 3249 |

(*C*) Combustion in Excess Air (1 Vol.).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. . . . . | 1880 | 2027 | 2173 | 2326 | 2482 | 2646 |
| 500° C. . . . . | 1970 | 2117 | 2263 | 2416 | 2572 | 2736 |
| 1000° C. . . . . | 2079 | 2226 | 2372 | 2525 | 2681 | 2845 |
| 1200° C. . . . . | 2129 | 2276 | 2422 | 2575 | 2731 | 2895 |

(*D*) Combustion in Excess Air (2 Vols.).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. . . . . | 1620 | 1785 | 1931 | 2087 | 2251 | 2418 |
| 500° C. . . . . | 1706 | 1862 | 2008 | 2164 | 2328 | 2503 |
| 1000° C. . . . . | 1801 | 1957 | 2103 | 2259 | 2423 | 2598 |
| 1200° C. . . . . | 1844 | 2000 | 2146 | 2302 | 2466 | 2641 |

(*E*) Combustion in Excess Air (3 Vols.).

| Temperature of Gas Entering Furnace. | Temperature of Excess Air Entering Furnace. | | | | | |
|---|---|---|---|---|---|---|
| | 0° C. | 200° C. | 400° C. | 600° C. | 800° C. | 1000° C. |
| 0° C. . . . . | 1435 | 1591 | 1745 | 1906 | 2073 | 2246 |
| 500° C. . . . . | 1504 | 1660 | 1814 | 1975 | 2142 | 2315 |
| 1000° C. . . . . | 1588 | 1744 | 1898 | 2059 | 2226 | 2399 |
| 1200° C. . . . . | 1626 | 1782 | 1936 | 2097 | 2264 | 2437 |

Where high temperatures are required for furnace work, preheating is essential; and it is customary to supply the gas to the combustion chamber as hot as possible, with little or no preheating, and to preheat the air for combustion as thoroughly as possible by means of the heat contained in the products of combustion as they leave the combustion chamber. The great amount of heat contained in the products is shown in Tables IX. to XVI., and by reference to Tables I. and V., they can quite easily be converted into K.C.U. or B.Th.U.

(*To be continued.*)

## Mr. Copp Leaves Etruria.

An interesting function took place in the Workmen's Hall at the Etruria Gas-Works last Friday, in the form of a tea given by the staff and employees of the British Gaslight Company, Ltd. (Potteries Station), to Mr. Harold E. Copp, on the eve of his departure to take over the management of the Company's Hull station. Mr. Copp, after tea, presented medals and certificates to two of the employees of the Company who had completed twenty-five years' service. Mr. J. Warrillow, the Assistant Manager, who afterwards presided—supported by Mr. H. M'Gilchrist, Mr. J. R. Heath, Mr. H. Lawton, Mr. J. Pemberton, and other members of the staff—referred in felicitious terms to the services rendered by Mr. Copp to the Compaay, and to the happy relations which had subsisted between him and the employees. He said that, though they were pleased at the honour conferred on him, they were very sorry to lose him. A presentation—consisting of a Wedgwood tea service, a set of Coalport vases, a trinket set, and a rose bowl—was then made to Mr. and Mrs. Copp by Mr. John Hammond, one of the oldest employees of the Company. Complimentary references were also made by Mr. M'Gilchrist and Mr. Pemberton. Mr. Copp, in accepting the presentation, referred in feeling terms to the happy relationship that had existed between himself and those present, and voiced his heartfelt thanks for the beautiful gifts, which would always serve to remind him of the happy period he had spent in the Potteries. Mrs. Copp also expressed her thanks and appreciation.

## RESEARCHES ON THE CHEMISTRY OF COAL.

At the meeting of the Royal Society on May 15, Prof. W. A. Bone and Mr. R. J. Sarjant read the first part of a paper on this subject. It recorded the results of an experimental investigation of the so-called solvent action of pyridine and homologues upon the coal substance, with the double object of clearing-up certain discrepancies in the work of previous investigators and of determining the real nature of the action in question. It was shown that the presence of oxygen has an important retarding action upon the extraction process (the extent of which varies considerably with the nature of the coal), and that in order to obtain consistent results in any such process it is necessary not only to employ an anhydrous solvent, but also to exclude oxygen. The application of the method to two typical isomeric bituminous coals is fully described. It was shown that when such extraction is carried out at ordinary pressures, with the exclusion of oxygen, a practical limit is finally attained. In the case of the two coals in question, this limit considerably exceeded the amount of the "volatiles" yielded by them on carbonization at 950°. At higher pressures, this first limit was a long way passed; and when conducted in sealed tubes between 130° and 150°, as much as two-thirds of the coal substance was rendered soluble.

## OVEN PLANT AT KALAMAZOO.

A modern gas-oven plant built by the Parker-Russell Mining and Manufacturing Company, of St. Louis, for the Michigan Light Company at Kalamazoo, is described by Mr. Louis Resnick, in the "American Gas Engineering Journal." This plant, which has been in operation for eight months and has proved to be highly satisfactory, consists of fifteen ovens, with a coal capacity of 4 tons each; the production, with a twelve-hour carbonizing period, being 1¼ million c.ft. of gas per 24 hours. Taken over a period of thirty days, the following results were recently obtained: A yield of 5·3 c.ft. of gas per pound of coal of an inferior grade; the gas having a calorific value of 580 to 590 B.Th.U. per cubic foot. The tar yield averaged 14 gallons per ton of coal carbonized, and the yield of ammonia 5 lbs., with apparatus somewhat inadequate for its recovery. The fuel consumption averaged, on a dry basis, 280 lbs. per ton of coal carbonized. The installation was designed primarily to give a maximum yield of high-grade gas and bye-products and coke suitable for domestic fuel; but with the proper coal mixing and pulverizing apparatus, the ovens can produce metallurgical coke. By a special arrangement of the heating flues, the upper part of the carbonizing chamber, which is not filled with coal, is subjected to a less degree of heat than the balance of the chamber. This cools the gas coming from the charge—preventing the breaking-up of the gas, and the consequent formation of lampblack and pitch. There is a gas-flue located just above each oven, running its entire length, and connected to it by the coal-charging holes. The gas coming from the charge is further cooled by passing through this flue to the gas off-take at the end, instead of directly over the charge.

# CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

## The "Control Price" of, and the Export of Surplus, Sulphate of Ammonia.

SIR,—In the current issue of the "JOURNAL" your correspondent, speaking of sulphate of ammonia, states the "control has now been removed." This is far from being the case.

In common with other makers, a fixed proportion of our production has been reserved for home consumption. It will be observed from a reply given in the House of Commons the other evening by the Parliamentary Secretary to the Board of Agriculture, that the price fixed for this is "below its cost of production." Why the already heavily handicapped gas companies should be required to supply sulphate of ammonia under cost passes my comprehension. Having submitted to this extraordinary condition, however, it might reasonably be assumed that the surplus sulphate not required for home consumption might be freely exported, having regard to the conditions at present ruling in the export market. [I might say 90 p.ct. of our make was so dealt with before the war.] But the Board of Agriculture refuses to issue a licence to us, and refers us to a Committee of trade competitors.

We have been told that we were the only people who object; but I know of other undertakings who are as opposed to the arrangement as ourselves.

Surely the Sulphate of Ammonia Association might have done more for the gas industry.

We want to get as many as possible of the vexatious controls which hamper industry in all directions removed, instead of bolstering them up.

CHARLES CARPENTER.

*South Metropolitan Gas Company,*
*June 6, 1919.*

[Consequent on the Whitsuntide Holidays, the above letter was not received till after the "JOURNAL" for the 10th inst. had gone to press.—ED. "G.J."]

## Development of Verticals and Initial Troubles Conquered.

SIR,—I should not be doing my duty to the gas profession, the users of our vertical retorts, and myself, if I did not take notice of the remarks made by Mr. D. C. Cross and others respecting some troubles when working verticals, at a meeting of the London and Southern District Junior Gas Association, and your comments thereon.

I should first like to ask the following question: Was there ever an important and useful invention introduced that did not give some trouble, and cause some anxiety to the inventors and first users of any new and modern appliances—especially where special education had to be imparted to all supervisors and workmen who had to manipulate the machinery and plant of which they had not had any previous experience?

It may be well to give examples of some troubles that we had to contend with during the early stages and introduction of the vertical system. At one good-sized provincial gas-works, soon after the plant had been very satisfactorily started by the aid of our operators, the worst of troubles began to take place—such as hanging-up of the coals in the retorts, ascension-pipes blocked through the erratic working of the exhausters, and the furnaces neglected—and in consequence the town was very nearly in darkness. We were communicated with, and very soon put things right again. All this trouble and annoyance was brought about by a disinterested and unworthy assistant who unfortunately had charge of the plant, but did not carry out the rules laid down for his guidance, or properly direct the stokers in their new duties. The engineer therefore appointed another assistant who understood and properly carried out his duties, and a transformation immediately took place. Nothing has gone wrong since; and they have for years been producing most excellent results regularly and systematically day by day and week by week.

At another works, the foremen were quite indifferent, and did not discharge their duties by carrying out the rules laid down or properly looking after the stokers at their work. Durham coals were used. The engineer made a change at these works, and appointed some good men, upon which things were soon rectified, and most excellent results are being recorded.

In the great majority of cases, after the starting of the new plant we leave with the engineer printed detailed rules, based on past experience, both for his own and the workmen's guidance for operating the plant; and he generally—at least, for a time—gives the working of the new plant his special attention. There, in most cases, no difficulty or trouble ever arises. As one of the examples, Mr. Hubert Pooley, of Leicester, was very desirous that I should personally instruct one of his managers and son in all details connected with the working of the new system; and I found that these two men, who would be responsible for the working of the plant, had been daily watching the erection of the installation. I found them to be most intelligent, and very interested in the new process. They took careful note of all my instructions and advice; and at the time I pointed out that there would not be any difficulty arise with this plant, as the manager had a thorough grip of all the necessary requirements for efficient working. Nothing has gone wrong—after being in operation several years, producing all the time most excellent results—and it is one of the cleanest works I know of.

You will observe that, for successful and most efficient working, the personal element enters very largely into the calculation.

We have naturally had a few structural defects to contend with, which could only be ascertained by practical experience; and this is what happened in Mr. Cross's case. The retorts turned out somewhat defective; but when the defects were known, they were rectified, and this trouble will not occur again. He has, however, shown his high appreciation of the system by favouring us with another order for an extension.

I may say that, taking the large number of installations we have erected, the difficulties have been very small indeed; and in actual practice it has not caused us one-tenth part of the trouble to educate willing men into the working of the system that it did to educate men for working drawing and charging machinery. To-day I am not aware of any plant that is giving any engineer the least trouble or anxiety, and believe every plant is working very smoothly and satisfactorily.

As regards investigations into troubles, I may say that personally I very much encourage the idea of doing this, and I hope that some qualified engineer may be appointed for the purpose.

Respecting the remarks and comments of some of the juniors of the Association, I should like particularly to point out to them that one of the principal rules and duties when publicly debating any subject is for every member to be quite sure of his facts. One of the speakers said: "There were, he (the speaker) thought, very few vertical retorts which worked smoothly from one week's end to another. It was being found out that, in order to get the best results from the system, it was necessary to have a particular kind of coal." I wish to point out that all these remarks are very misleading, ungenerous, and absolutely untrue in every respect; and in answer to the first statement, I may say that I am not aware of any single case where the irregularities indicated by the speaker are taking place on any works using our verticals.

Then, again, as regards special fuel being required, this is an old fallacy, and ancient history re-introduced for a purpose. I have repeatedly in the past in the "JOURNAL" pointed out that I have personally tested coals from every country that supplies them throughout Great Britain, America, Australia, Germany, &c., and that I have never yet come across any coal I could not properly carbonize in the verticals and produce infinitely better results in each case than can be obtained with horizontal retorts, and with less cost for labour. Again, I may point to the excellent returns that have been recently published derived from various kinds of coal, from works ranging from the north to the south of the kingdom; and I should like to ask what better proof or evidence I can give on this point from a large number of responsible engineers.

In deference to some of these juniors, or "Job's Comforters," who appear to know very little of the subject they were trying to discuss, I am glad to reiterate that our verticals, as now being worked, are an unqualified success; and, again, I do not think that I can give more definite and reliable proof of the same than the testimony of a large number of important engineers who have been working the system for many years, and are now favouring us with a number of repeat orders upon a very large scale.

JOHN WEST.

*Southport, June* 14, 1919.

## The Education of a Gas Engineer.

SIR,—Prof. Smithells' delightful and sympathetic paper serves as a reminder of the old saying that it is the late comers who take the prizes. There can hardly be two opinions as to the necessity for coming into line with other branches of engineering on this matter of education, so far as may be practicable under existing conditions. But it appears to me that what is called the "sandwich" system is very much like asking for trouble, and might prove wasteful of the receptivity of the student. At all events, it can hardly be regarded as generally applicable. My own view (for what it may be worth) is that the student should have his full chance as a student, and that there should be no sensible break in the continuity of his studies. Occasional visits to works—by no means necessarily gas-works—I should regard as an essential part of his educational course, and may mention that, in a case in which I was personally interested, I obtained for him the run of a large engineering establishment during one of the long vacations. If the student makes good at his University, whether in following the prescribed engineering course or by striking out a line for himself, I should have but little fear of his turning out all right when faced with the practical work to which he may have been looking forward.

CHAS. HUNT.

17, *Victoria Street, S.W., June* 11, 1918.

## Co-Operative Housing.

SIR,—The enclosed does not furnish a pleasant impression- It is an extract from an article, on "Co-Operative Housing: A Novel Scheme at Lincoln," in the "Municipal Journal" for June 6.

"The lighting and heating plans present novel features. It is proposed to employ waste heat and steam from the firm's [Ruston and Hornsby's] works, and to have a combined system of central heating and hot-water supply to serve each house. In addition, electricity generated at a central station will be supplied to each house for lighting and cooking, and also to the village for different public purposes, such as street lighting, laundry power, and sewage pumping. It is estimated that the installation of a hot-water service and an electricity service in each cottage will cost £65; but as a set-off against this expenditure, there will be a saving, estimated at £54 per cottage, upon expenditure which would otherwise have been required in the provision of larger chimneys, grates, coppers, &c. The central station and the supply mains are estimated to cost an additional £250,000 for the 3000 houses."

If all the public utility societies are to be allowed to devise schemes of this sort, and no representation offered of the superior advantages of lighting and cooking by gas at the right time, it seems to suggest that there is something wrong about the new organization supposed to be advocating gas interests.

I am very much afraid that all this advocacy of low calorific standards, high pressures, and modified charges for beat units, is about to do a deal of mischief to an industry which just before the war broke out had reached a high degree of prosperity, and was in need of no interference from the Board of Trade, Lord Moulton, or the Chemical or the Coke-Oven Associations.

My attention has of late been drawn to occasions of gas being superseded by electricity where the calorific propaganda is in full blast. I may be wrong, but some of this propaganda appears to me to have originated in the Coke-Oven Association being anxious to find a commercial outlet for their waste gases.

Please note in particular what the President of the Coke-Oven Association stated quite recently: "The modern tendency of lighting authorities (*sic*) to dispense gas of a lower illuminating power but of constant and reasonable calorific value should be supported and encouraged wherever possible by members of the coking industries . . . because it permits of a co-operation between them and gas engineers which would not be so readily attainable if a very rich gas of high illuminating power were required."

This, if it should even strike you as plausible, is not very comforting when one hears of low-grade gas for power being discarded because it gave such unsatisfactory results, and electricity (introduced instead) proving thoroughly satisfactory in its driving power.

These are illustrations that cannot be gainsaid; and, although unpleasant, they are worthy of your attention.

The Board of Trade are bent on running electricity for all it is worth. Debasing gas may prove helpful; but there is no occasion for the gas industry unconsciously to help them.

ARTHUR SILVERTHORNE.

5, *Victoria Street, S.W., June* 7, 1919.

# PARLIAMENTARY INTELLIGENCE.

## HOUSE OF COMMONS.

### Coal Commission Interim Report.

Mr. WARDLE (the Parliamentary Secretary to the Ministry of Labour), replying to a question by Colonel Burdon, said that the publication of the volume containing the evidence given before the Coal Industry Commission in March was being pushed forward as rapidly as possible. The evidence alone contained over 10,000 questions, and the appendices were also very bulky. Unrevised and unbound prints of the evidence had been supplied to various persons and associations for the purpose of the preparation and presentation of evidence before Commission during the present stage of the inquiry.

# REGISTER OF PATENTS.

## Purification of Distillation Gases of Coal.

CISELET, E., and DEGUIDE C., of Brussels.

No. 9780; July 5, 1915. Convention date, July 6, 1914.

This invention relates to "the purification of the distillation gases of coal, which permits of extracting therefrom in a very efficient manner products of an acid character, such as sulphuretted and cyanogen compounds." It is said that the difficulties usually attending such a process are overcome according to the invention, as the purification is effected by means of a limited quantity of ammonia, which is constantly and automatically regenerated during the operation.

For this purpose, the distillation gases of coal are treated with a liquid consisting of caustic ammonia in solution and lime in suspension. The ammonia reacts with the gases, the acid products of which it transforms into sulphide, cyanide, and carbonate of ammonia, respectively. In the presence of lime these ammonium salts give rise to a double decomposition with the lime, and pass into the state of calcium salts; whereas caustic ammonia is regenerated, and can thereupon continue its purifying action. The ammonia has therefore the function of a mere vehicle between the gases from which it removes their acid products, and the lime to which it imparts these products immediately afterwards, which also retains them definitely. Thus as long as the quantity of lime is not exhausted, the same quantity of ammonia may continually serve for the purification of a continuous current of gas.

The process may be carried into effect in the following manner: The gases coming from the retorts are in the first place freed from their tar in the usual manner; and the acid products are subsequently extracted. To this end, the gases are passed through atomizers, in which they are placed in contact with a liquid containing caustic ammonia in solution and hydrate of calcium in suspension. This liquid (prepared in a very simple manner, by mixing lime water with a solution of caustic ammonia or with the ammoniacal waters of the gases themselves) reacts with the gases in two phases. The first phase is the absorption of the acid products by the ammonia:

$$H_2S + 2\,NH_3 = (NH_4)_2\,S.$$
$$H\,C\,N + NH_3 = NH_4\,C\,N.$$
$$CO_2 + 2\,NH_3 + H_2O = (NH_4)_2CO_3.$$

The second phase is a double decomposition between the ammonium salts and the lime:

$$(NH_4)_2\,S + Ca(OH)_2 = 2\,NH_3 + Ca\,S + 2\,H_2O.$$
$$(NH_4)_2\,CO_3 + Ca(OH)_2 = Ca\,CO_3 + 2\,NH_3 + 2\,H_2O.$$
$$2\,NH_4\,CN + Ca(OH)_2 = Ca\,(CN)_2 + 2\,NH_3 + 2\,H_2O.$$

The ammonia therefore does not remain in the state of a salt. It is constantly regenerated in the caustic state, and can pursue its purifying action as long as the quantity of lime is not exhausted. But after some time, it is advisable to eliminate the calcium carbonate, the precipitated mass of which increases rapidly. It is separated by filtration of the liquid, which contains (in solution) the sulphide and cyanide of calcium and ammonia.

## Producing Gas from Moist Fuel and Simultaneously Recovering Bye-Products.—No. 112,443.

THÄBERG, N. T., of Malmö, Sweden.

No. 18,911; Dec. 20, 1917.

This invention relates to the production of gas and simultaneously recovering bye-products when coking peat or other moist fuel without first subjecting it to a special drying process.

The fuel is subjected to drying before carbonization or combustion, and the steam generated, as well as any gaseous compounds produced during the drying—such as tar and compounds of ammonia—are directly removed from the drying chamber by a fan or an exhauster, after which they pass through an ejector which withdraws gases from the carbonizing or generating or gas producer chamber. The ammonia, tar, &c., formed in the drying chamber, as well as solid particles (such as dust and the like) intermingled with the last-mentioned gases being thus separated on account of the varying degree of humidity of the different gases.

Referring particularly to the use of moist peat as fuel, considerable quantities of ammonia and other valuable bye-products may be extracted from it in the manner indicated. The fuel thus dried and relieved of certain component parts is then admitted into the carbonizing or generating chamber in which other gases are formed.

## Quenching Coke.—No. 124,652.

FLOOD, G. A., of Swaffham, Norfolk, and FLOOD, W. H., of Sheffield.

No. 10,914; July 3, 1918.

This invention relates to the quenching of coke by other means than those usually performed by spraying water from hose pipes or sprinklers on to the mass of glowing incandescent fuel after it has been withdrawn from the oven—such water as is not converted into steam running off the fuel and away into culverts and drains provided for the purpose. Such a method is open to objection in that the outside portion of the charge of coke is often overquenched, and the pores are blocked up with fire breeze; also the interior of the mass does not get properly quenched—resulting in the formation of "hot spots." An alternative method of quenching coke is to employ a coke-carrying cradle which is immersed in a tank containing water.

The patentees have devised apparatus for quenching coke, in which the above-named objections are said to be wholly eliminated, resulting in the production of coke which is uniformly quenched and clean and dry. Their invention consists in quenching coke contained within a receptacle, by water flowing into the receptacle and rising upward in it from the bottom of the incandescent mass until the whole is submerged, and, after a suitable interval, running off the water quickly from contact with the coke. The invention also includes a special form of tank or receptacle with a gridded floor, covering a valve chamber in which are the valve controlled outlets of the tank.

## Distilling Oil from Coal.—No. 125,528.

WISE, W. H., of Falmouth.

No. 8624; May 24, 1918.

The object of this invention is to distil oils from coal by a continuous, automatic process of turning over and over and raking the material through long ovens wherein the temperatures are graduated. The material is admitted from a hopper by way of an airtight rotary feeder into the oven, which is heated by fire and gas in part from a furnace, in part by residual gases from the process. A combustion chamber leads to flues under, and longitudinal to, the floor of the oven.

The residual gas is preheated by passing through the hollows of bricks set under the flues; and air for the combustion chamber is preheated by passing through cavities in the walls of the oven.

The material is turned over and over and raked from end to end of the oven by spades depending from a frame (running on wheels on rails) moved in reciprocal motion by (say) a hydraulic ram.

The frame is held in tension by a balance weight; while the spades are hung as a door to open one way only. On the forward stroke they rake the material. They are balance weighted, and a connecting bar engages with a catch stop so that the continuing movement of the frame causes them to feather (as an oar) and turn over the material.

At the end of the oven an airtight rotary discharger delivers the spent material to a bin. Vapours from the material are collected by pipes connected to a trunk as usual and go thence to a condenser. The subsidiary plant is ordinary.

## Treatment of Carbonaceous Substances. No. 125,698.

MULLINER, H. H., of The Albany, Piccadilly, and KENT, A. T., of Sutton, Surrey.

No. 5014; March 21, 1918.

This invention relates to the treating of cannel coal or shale, so as to obtain as large a yield as possible of oil of even quality (such as fuel oil), which can be "produced direct without the usual redistillation, and without impairing the quality or quantity of the gas and sulphate of ammonia obtained." Another object of the invention is to provide a process that can be carried out in retorts as now used in gas manufacture—such retorts being "readily converted for oil production and at once reconverted to the former working when desired."

The carbonaceous materials are fed into the top of a vertical retort of the continuous or semi-continuous type, preferably externally heated. Coal gas or water gas at a low pressure is continuously supplied to the bottom of the retort, or steam combined with stripped coal gas or water gas (produced in the lower end of the retort) is superheated in passing through the hot coke leaving the retort, and passes upwards in direct contact with the charge—carrying forward the oil vapours which, together with the coal gas and steam, are drawn off from the top of the retort under a slight vacuum. Preferably the charge is maintained at a temperature of about 500° C. at the lower end of the retort, diminishing to about 200° C. at the top. These temperatures in ordinary working, however, may be varied to suit the type of retort and the nature of the materials to be carbonized, but must not be less than 500° C. at the bottom of the retort, or allowed to fall so low that the steam or vapours are condensed inside the retort.

The conditions of working may be readily varied by altering (1) the speed of the charge through the retort; (2) the external heating of the retort; and (3) the temperature and quantity of the steam supply.

In a retort externally heated only, the charge is heated unevenly throughout its cross-section, the oil vapours are cracked near the walls of the retort, and the quantity of carbonized material passing through is low. But with superheated steam or gas passing through the retort in direct contact with the charge, a more even temperature is maintained throughout, the cracking of the oil vapours is avoided, and the output of the retort is greatly increased.

The gas yield can be increased by the known means of raising the temperature of the charge at the lower end of the retort to decompose part of the steam. The water gas produced in the lower part of the retort combines with the coal gas during its passage through the retort. Also when making water gas in a vertical slot retort about 20 p.ct. by weight of steam at about 20 lbs. pressure to the material carbonized has been found suitable—the steam being superheated by known means before introduction into the retort.

The patentees state that they are aware of patents No. 67 of 1890, No. 28,791 of 1912, No. 6613 of 1915, and No. 114,937, and make no claim to the inventions described therein. They do not attach any drawings to the specification given above, practically in full.

## Furnaces for Heating Metal Articles.—No. 126,163.

GIBBONS BROS., LTD., and MASTERS, R., of Dudley.

No. 8040; May 14, 1918.

This furnace is, broadly speaking, of the kind described in patent No. 7203 of 1912—circular with a domed top and having several charging apertures round its periphery through which the articles to be heated can be introduced on to the floor of the furnace and, when sufficiently heated, can be withdrawn.

In such a furnace the down-cast waste-gas passages between the charging doors communicate with an arc-shaped waste-heat flue arranged below the floor and below the regenerator passages, which

latter are built straight and parallel with the sides of the fuel chamber when viewed in plan. They are of known construction, forming zig-zag passages for the secondary air as it passes upwardly through them. Also the hot secondary air outlets from the regenerator passages communicate with ports in the top of the gas-producer or fuel chamber immediately below the arched top.

### Valves and the Like.—No. 126,421.

IONIDES, A. C., JUN., of Porchester Terrace, W.

No. 5978; April 8, 1918.

This invention relates to regulating valves in which two co-operating rectangular portways formed in the surfaces of adjacent cylindrical casings (and having their longer dimensions parallel with the axes) are simultaneously adjusted in length by piston valves adapted to slide in an axial direction in the casings by the movement of common actuating means. The patentee's object is to provide valve mechanism for controlling simultaneously the flow of two fluids which are to be mingled in determined proportions.

The valve allows the proportions between two fluids to be mingled to be adjusted and maintained as constant as possible during variations of quantity by a pair of simultaneously actuated pistons or plungers slidable in an axial direction in barrels having long narrow longitudinal ports, and one or both barrels being rotatable to vary the relationship between the widths of the ports. In such a regulating valve the barrels take the form of two hollow cylinders of similar diameter, and mounted parallel with one another in a casing in which ports are provided to co-operate with the ports in the barrels—the pistons or plungers being operated in common by a screw co-acting with a nut in the casing and provided with markings to determine the port lengths.

### Heating Gaseous Fluids.—No. 126,477.

IONIDES, A. C., JUN., of Porchester Terrace, W.

No. 7958; May 11, 1918. No. 19,827; Nov. 30, 1918.

This combined invention relates to heating in apparatus consuming a combustible gaseous mixture of two constituents—for example, gas and air—correctly proportioned, at constantly related pressures above that of the atmosphere, for complete combustion in a chamber from which air is otherwise excluded, and the waste products are expelled without the suction of a chimney or the equivalent. The heat generated is utilized in apparatus comprising an extended tubular member leading the products of combustion from a combustion chamber to a discharge communicating with the atmosphere at a lower level than the combustion zone—the member and chamber being enclosed in a duct in which the gaseous fluid to be heated flows generally in a contrary direction to the products of the gaseous combustion.

The invention also consists in improvements in heaters of the type described for imparting any desired temperature to a gaseous medium, for any purpose—say, when heating air, which is required for drying or heating wares which would be injured by the direct application of the products of combustion of the fuel utilized to supply the heat.

Two sheets of closely-lettered diagrams accompany the specification.

### Propulsion of Gas through Pipes.—No. 126,857.

AYRTON, H., of Norfolk Square, Hyde Park.

No. 11,199; July 8, 1918.

According to this invention, impulses are given to the gas (as or before it enters the pipe, and during its passage through it), by means of apparatus acting upon the gas by the impact of flexible or semi-flexible blades, flaps, or the like. In addition, means may be employed, when desired, for exhausting the gas at the delivery end of the pipe. Apparatus acting in the manner stated is described in patent No. 8541 of 1915. The impelling apparatus is disposed in a chamber located at one end of the pipe through which the gases are to be forced, and in direct communication with the gas. Other chambers provided with impelling apparatus may be disposed at intervals along the pipe, preferably connected so as not to present any obstruction to the flow of gas from the chamber to the pipe or from the pipe to the next chamber.

The action of impelling apparatus of the kind referred to is such that each impulse produces a vortex in the gas acted upon, rotating so that its upper surface moves towards the impelling apparatus while the volume of gas as a whole is violently impelled away from said apparatus.

In the course of his specification, the patentee remarks: "The advantage which has been brought to light by my investigations, to be gained per unit of energy employed by the combination of impulses of the kind with an enclosed passage (such as a pipe) for the gas, is sufficiently pronounced to show that I have made a very important discovery, capable of extensive application; and I intend therefore to claim as my invention the combination of the two elements in the most comprehensive sense, whatever kind of enclosed passage for the gas may be employed."

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**The Price of Benzol.**—The Automobile Association are informed by the National Benzol Association that the price of benzol, conforming to the approved specification, is 2s. 8d. per gallon in 50-gallon drums and 2s. 9d. per gallon in 2-gallon tins. These prices, which it is said will be still further reduced in the future, represent a saving of 4d. per gallon on the present price of No. 1 petrol at most garages. As at least 15 p.ct. more mileage can be obtained from benzol than from the best petrol, the equivalent price per gallon is 2s. 4d. for benzol as against 3s. 1d. for petrol.

# MISCELLANEOUS NEWS.

## GAS INDUSTRY AND THE COAL COMMISSION.

### Examination of Mr. Milne Watson and Mr. A. E. Broadberry.

Up to the time of going to press with last week's "JOURNAL"—which had to be early, owing to the Whitsuntide Holidays—our report had not come to hand of the replies given by Mr. D. Milne Watson and Mr. A. E. Broadberry to questions put to them by members of the Coal Industry Commission when they appeared as witnesses. A *précis* of their evidence was, however, published on pp. 705-6, and this it is to-day possible to supplement by some account of the subsequent proceedings.

Mr. D. MILNE WATSON examined.

By Sir L. CHIOZZA MONEY: He quite admitted that, during the war, the trade and the Coal Controller were working under very abnormal circumstances; and he did not wish to take all that happened during the war as indicating what would happen in normal times. But their experience had been such that they were very unwilling to see the State as a buyer and purveyor of all the coal in the country. Speaking generally, the gas companies had very little difficulty in getting the coal they required. The question of price was a matter for arrangement. Of course, there might be instances of collieries having taken advantage of the knowledge that one coal was more suitable than another, and trying to put the screw on. But the number of collieries and the number of varieties of coal were so large that it was unthinkable that this could not be got over by the purchase of more suitable coal. In his experience with the collieries, he had never had that sort of thing to contend with. He had been buying coal for twenty years; and there were contractors who had been supplying his Company for thirty years—one contract going back as far as 1873 without a break. He did not imagine that any Minister of Mines (should one be appointed) would deliberately go out of his way to place difficulties in the way of a gas company; but it would be a very difficult thing, without an enormous staff, to arrange to supply the coal that was required. When it was realized that there were literally hundreds of varieties of coal, it would be seen that it was quite a different thing to the supply of electricity or water or gas, or even the Post Office and telephones, where there was no question of variety in the article. In one colliery alone, there would be several different grades of coal—some suitable for gas making, others quite unsuitable. All this had to be studied. Certain coals were not gas coals at all; but even when they did get gas coal, some varieties were totally unsuitable for various works. To find the proper coal for a particular works was a science in itself. All this would mean, if there was going to be no hitch or trouble, an army of technical experts so as to place the coal properly. Taking the case of a very good gas coal seam which was greatly in demand, the allocation of the coal would be a matter of considerable difficulty. He had heard it stated recently that if the coal mines were nationalized, there would be a level price, which would be a reasonable one, and there would be no competition. Of course, this sounded very attractive; but how was it going to be arrived at? Under the present system, if there was a coal that several people were competing for, the one who paid the price asked got it—it settled itself. Supposing two cargoes of coal arrived at their pier at Beckton, one coal containing 25 p.ct. of ash and another 10 p.ct., and it was a question of sending the cargo up to their Kensal Green works (a haulage which cost about 3s. or 4s. a ton), there was no doubt as to which coal they would send. Of course, they would send the coal with little ash in it, because they got more coal for the amount of money they spent. Therefore it would always happen that the gas company which was the greater distance away would get the advantage. The coal with the highest calorific value would be sent the greatest distance. He was not aware that it was a fact that gas companies, as compared with municipalities supplying gas to the public, had a larger capitalization per 1000 c.ft. of gas sold. There was no doubt that the municipalities were often in a good position with regard to the coalfields. Going by "Field's Analysis," taking the three great Metropolitan companies, the capital employed per 1000 c.ft. was 10s. 1d.; whereas ten or twelve individual corporations put together worked out at 10s. 4d. In the Suburban companies, the capital employed was as low as 8s. 4d., compared with certain Provincial companies which worked out at 8s. 11d. After all said and done, what really counted was the price of gas. He had taken out the figures for eleven Provincial companies over a series of five years, with this result: For the year 1917, the average companies' price was 26·69d.; and for the corporations which he had quoted the figure was 31·12d. In 1916, for companies 25·4d.; for corporations 27·89d. In 1915, for companies 23·69d.; for corporations 27·02d. In 1914, for companies 21·63d.; for corporations 23·16d. In 1913, for companies 21·48d.; and for corporations 23·2d.

By Sir ARTHUR DUCKHAM: The number of small companies privately owned was considerably greater than the number of small undertakings owned by municipalities. Therefore their capital cost would be greater. Under coal nationalization, they could never be sure that they would be able to purchase the coal they wanted; and there would be absolutely no redress. With every desire to appreciate what officials had done and tried to do, he failed to see how there could be a remedy.

Mr. A. E. BROADBERRY examined.

By the CHAIRMAN: He was not in favour of nationalization. The only indication that he had had of the effect of nationalization was what gas companies had been experiencing during the last two-and-a-quarter years with the control under Government; and it was very clear from this that very little sympathy would be got from a Government department in making arrangements as to what coal they might have, or might not have.

By Sir L. CHIOZZA MONEY: He was well aware that during the

war England had had to export large quantities of coal to France and Italy; but his point was that through the control, the production of coal had been wasted. He rather doubted the statement that by the transport arrangements that had been made, 700 million coal ton-miles had been saved. He would not like to suggest that Sir Guy Calthrop had "played the fool" with their coal; but he thought he was entrusted with a job that was more than he could properly manage. He did not consider that the gentleman who had now been put in charge of the distribution of the coal by the Government had any knowledge of coal. He was an expert railway man. The Coal and Coke Supply Committees were set up at the beginning of 1916; and the Coal Controller was not appointed until 1917. But the gas companies were allowed during the year 1916 to make their own purchases from collieries; and very little interference came from the Coal and Coke Supply Committees.

## SULPHATE OF AMMONIA SALES.

### The Arrangements for 1919-20.

The makers of sulphate of ammonia have recently received from the Sulphate of Ammonia Association quite a batch of literature which informs them of the arrangements that have been concluded with the Board of Agriculture in connection with the period over which there shall be retention of a specified quantity of sulphate of ammonia for home use, together with the prices. It will be seen that the Committee declined to enter into any arrangement regarding the fixing of prices for a period longer than the June-September delivery, when the matter of price for the remainder of the season will again come under consideration. The scheme agreed to is embodied in a circular from which we have taken the following.

EQUALIZATION SCHEME—1919-20.

A voluntary arrangement shall be made by makers of sulphate of ammonia with the Board of Agriculture for the year commencing June 1, 1919, whereby the makers agree to reserve sulphate of ammonia for home agricultural use at prices to be agreed from time to time with the Board by the Makers' Equalization Committee, in return for a guarantee from the Board that export licences shall be freely issued for the surplus not required at home.

Any quantity of sulphate of ammonia, or equivalent nitrogenous fertilizer of enemy origin, distributed by the Government in the United Kingdom, shall be regarded as part of the makers' quota, and as releasing them from their obligation to reserve an equivalent quantity of British sulphate if the makers so desire; and it is understood that the Board will consult the Equalization Committee on the distribution of the enemy material.

Prices for home agricultural use shall be fixed in the first instance only for the period June 1-Sept. 30, 1919; and the Equalization Committee shall summon a further meeting of all makers before agreeing prices with the Board of Agriculture for periods beyond Oct. 1, 1919:

(*a*) The price for sulphate of ammonia containing 24½ p.ct. by weight of ammonia ($NH_3$) during the period June 1-Sept. 30, 1919, for delivery to manure mixers and makers of compound fertilizers shall not exceed £19 10s. per ton (less a trade discount of 10s. per ton), delivered to purchaser's nearest railway station or wharf in Great Britain, or f.o.b. British port for Ireland and the Isle of Man—provided that, in the event of the price of sulphate of ammonia for delivery during the period Oct. 1, 1919-May 31, 1920, being subsequently agreed at a less sum than £19 10s. per ton, a rebate will be made on all such sales, so as to reduce the price per ton actually charged to such less sum, but so that the rebate shall not in any case exceed £2 10s. per ton. The total quantity sold on these terms not to exceed 35,000 tons, for delivery in equal monthly quantities, June-Sept., 1919.

(*b*) The price for sulphate of ammonia containing 24½ p.ct. by weight of ammonia to agricultural merchants and co-operative societies, for sale to farmers, or to farmers direct, for direct and immediate application to the land during the period June 1-Sept. 30, 1919, shall not exceed £17 per ton (less a trade discount of 10s. per ton when sold to agricultural merchants and co-operative societies), delivered to consumer's nearest railway station or wharf in Great Britain and f.o.b. British port for Ireland and the Isle of Man—the total quantity to be supplied at this price not to exceed 5000 tons for delivery in equal monthly quantities, June-September, 1919. Orders received from manure mixers for sale as above for immediate application to the land, whether direct or in compounds shall be treated as agricultural merchants' orders.

(*c*) Orders for delivery at these prices to be sent by buyers to the Equalization Committee, who shall allocate them among individual makers at their discretion.

All sales for export shall be made by the Equalization Committee through the Sulphate of Ammonia Association or other the agents of the Committee for the time being, to members of the Sulphate of Ammonia Export Traders, No. 16, Mark Lane, London, E.C. A commission of 1½ p.ct., calculated on the Equalization Committee's net selling price, in single bags, f.o.b. British port, shall be paid to the members of the aforesaid traders on condition: (*a*) That the traders shall give to the Committee "first refusal" of all orders which they may obtain for shipment of sulphate of ammonia to any destination outside the United Kingdom (except the Channel Islands and the Isle of Man). (*b*) That the aforesaid traders' profit shall be limited to the above commission; and that the traders shall satisfy the Committee that any sums which they may add to the Committee's prices to cover risks of loss in weight, interest, freight variations, &c., shall be reasonable and warranted by the circumstances. (*c*) That the Committee shall have the right to have the books of the aforesaid traders examined by chartered accountants. The Equalization Committee shall make the best arrangement they can with the aforesaid traders with regard to any undelivered balance of the 30,000 tons of sulphate of ammonia provided for in the equalization scheme in operation from June 1, 1917 to May 31, 1919.

In order that the distribution of sulphate of ammonia between the home buyer and exporting firms may be regulated as above, the Board of Agriculture shall only recommend the issue of licences in respect of applications to export made by or on behalf of the Sulphate of Ammonia Equalization Committee.

The Equalization Committee, through their agents, shall purchase the sulphate of ammonia licensed for export, from individual makers at a "basis price" (f.o.r. or f.i.b. at works, new single bags free, net cash, basis 24½ p.ct. ammonia, with 4s. per ton extra for each complete one-fourth of 1 p.ct. over 24½ p.ct., and with 4s. per ton less for each one-fourth or fraction of one-fourth of 1 p.ct. below 24½ p.ct., and 5s. per ton extra if the free acid content shall not exceed 0·025 p.ct.), to be fixed from time to time by the Committee in accordance with the market value. The surplus—being the difference between the basis prices paid to the makers and the prices realized, less working expenses—shall be divided among all makers in Great Britain and Ireland, parties to this scheme, at the end of every three months in proportion to their total production for the three months, provided that:

(*a*) Any extra premium (over the 5s. per ton as aforesaid) obtained for sulphate of ammonia exported, containing less than 0·025 p.ct. free acid, shall be credited to the maker who supplies on the quantity delivered.

(*b*) The Equalization Committee shall be, and hereby are, empowered to set aside out of the aforesaid surplus accruing during the period, June 1 to Sept. 30, 1919, a sum sufficient to discharge the liabilities incurred to the mixers under Clause 3 (*a*), and to the makers under Clause 3 (*b*), and to place on deposit or invest such sum in trustee securities at their discretion.

(*c*) The Equalization Committee shall pay monthly to makers on their deliveries under sales made in accordance with Clauses 3 (*b*) and (*c*), the difference between £15 17s. 6d. per ton net cash f.o.r. or f.i.b. works, new single bags free, and the "basis price" defined in Clause (6).

(*d*) In the event of the "basis price" having to be reduced below £18 7s. 6d. per ton during June-Sept., 1919, makers delivering under sales made in accordance with Clauses 3 (*a*) and (*c*) shall refund to the Equalization Committee the difference between £18 7s. 6d. per ton and the average "basis price" for these four months on such deliveries.

(*e*) Any surplus out of the sum set aside which shall remain over after all liabilities under Clauses 3 (*a*) and (*b*), shall have been discharged, together with the total accrued interest, shall be divided among the parties to the scheme in proportion to their total production during the months, June-Sept., 1919.

With regard to the Channel Islands, the price shall be as for Ireland, provided the Channel Islands' Government agree to prohibit the export of sulphate as such or in compounds. Failing such prohibition, orders for the Channel Islands to be treated as export orders.

The Board of Agriculture shall be requested to open a sulphate of ammonia home delivery charges pooling account with each maker, on the basis of an average cost of delivery of 12s. 6d. per ton—any surplus or deficit to be divided among all makers in proportion to their total production for the year ending May 31, 1920; and all makers shall enter into an agreement with the Board of Agriculture.

With a view to economizing delivery charges in the interests of the makers, all home orders shall, as far as possible, be collected and allocated by the Equalization Committee; and makers shall communicate with the Committee before accepting orders involving delivery charges of more than 5s. per ton, with a view to such orders being placed with nearer works, if available. Further, a preference shall be given in all cases to local orders; and no orders f.o.b. British port for shipment to Ireland, the Isle of Man, or the Channel Islands shall be accepted without prior reference to the Equalization Committee.

With a view to preventing speculation by brokers at the expense of farmers, agricultural merchants, and co-operative societies, and in order to enable the maker to ascertain the cost of delivery, brokers' orders shall not be accepted unless the country to which delivery is required is strictly defined in the contract.

All contracts for home agricultural use shall contain a clause providing for payment by the buyer of a penalty of £20 per ton in the event of the sulphate of ammonia so sold being resold for export or exported in any form.

Makers shall be at liberty to make sales for home industrial purposes at the best price they can obtain and without restriction as to quantity.

This scheme shall be called the Equalization Scheme (1919-20), and shall come into force on June 1, 1919, and end on May 31, 1920. The scheme shall be worked by the Committee of fourteen makers of sulphate of ammonia elected at the general meeting of makers held at Cannon Street Hotel, London, on April 11, 1919, who shall be called the Equalization Committee, and shall have power to co-opt three additional members from amongst the makers.

OFFERS TO FERTILIZER MANUFACTURERS, FARMERS, &C.

In another circular, the further information is given that, with a view to encouraging the use of sulphate of ammonia at home, and to enable manufacturers of compound fertilizers to obtain sufficient supplies during the next four months at a price very substantially lower than the present export price (about £28 to £30 per ton f.o.b.), sulphate of ammonia makers have entered into an agreement with the Boards of Agriculture for England, Scotland, and Ireland to offer supplies on certain terms and conditions. The makers have appointed a Committee of fourteen manufacturers of sulphate of ammonia, called the "Equalization Committee," to carry out the provisions of the scheme which has been approved for dealing with home and export orders; and the organization of the Sulphate of Ammonia Association has been placed at the Equalization Committee's disposal for this purpose. All orders in connection with the offers, and all orders for

export (whether of sulphate as such or in compounds), should be sent to the Equalization Committee. The offers are as follows:

(*a*) *To Manufacturers of Compound Fertilizers only.*—The Equalization Committee offer, on behalf of sulphate of ammonia makers, for delivery in equal monthly quantities, June-September, 1919, inclusive, not exceeding 35,000 tons of sulphate of ammonia for use only in the manufacture of compound fertilizers for home agricultural consumption, at £19 10s. per ton (less 10s. per ton discount), single bags free, basis 24½ p.ct. ammonia, with 4s. per ton extra for each complete 0·25 p.ct. ammonia over 24½, and 4s. per ton less for each 0·25 p.ct. or fraction of 0·25 p.ct. ammonia if below 24½, delivered to purchaser's nearest station or wharf in Great Britain (or f.o.b. British port in the case of sales for Ireland, Isle of Man, or Channel Islands), or *ex*-works to purchaser's road vehicle, with a "fall" clause limited to £2 10s. per ton, which shall become operative as follows:

> "In the event of sales being made by or with the consent of the Equalization Committee of the Sulphate of Ammonia Association for home agricultural use at figures which average to less than £19 10s. per ton for the eight months October to May, 1919-20, then within the limit of £2 10s. per ton, the price to the mixers on deliveries made to them by or with the consent of the Equalization Committee between June 1 and Sept. 30, 1919, shall be reduced accordingly in respect of a total quantity not exceeding 35,000 tons of sulphate of ammonia, and the difference in price will be refunded to the mixers at the end of May, 1920—*e.g.*, if the average home selling price to farmers for October-May is £18 10s. per ton, the refund to the mixers will be £1 per ton; and if the average home price is £15 10s. per ton, the refund to the mixers will be £2 10s. per ton only. The average home prices shall be determined for the purpose of this clause by the weekly quotations made by, or with the consent of, the Equalization Committee during the eight months October to May without reference to quantities."

(*b*) *To Farmers, Fertilizer Manufacturers, Agricultural Merchants, and Co-Operative Societies.*—For direct and immediate application to the land only, and solely with a view to supplying any small demand there may be for this purpose, the Equalization Committee offer, on behalf of sulphate of ammonia makers, a total quantity not exceeding 5000 tons for delivery June-September, 1919, for home agricultural consumption at £17 per ton (less 10s. per ton discount, except to farmers), single bags free, basis 24½ p.ct. ammonia, with 4s. per ton extra for each complete 0·25 p.ct. ammonia over 24½, and 4s. per ton less for each 0·25 p.ct. or fraction of 0·25 p.ct. ammonia if below 24½, delivered to purchaser's or consumer's nearest station or wharf in Great Britain (or f.o.b. British port in the case of sales for Ireland, Isle of Man, or Channel Islands), or *ex*-works to road vehicle to be provided by purchaser.

This offer applies also to orders from fertilizer manufacturers for use in compounds for immediate application to the land, as defined above. It will provide a total quantity of 1250 tons for each of the four months June-September. Should the total monthly quota not be applied for in any month, the balance will be regarded as cancelled.

In the case of both (*a*) and (*b*) the sulphate of ammonia maker may charge 5s. per ton extra if he guarantees the free acid not to exceed 0·025 p.ct., and a further 5s. per ton for sulphate specially ground at purchaser's request.

The above prices are for deliveries of 2 tons and over, and the same scale of extras applies for deliveries in smaller lots as under the Fertilizer Prices Order, 1918. But no allowance in price will be made for taking delivery *ex*-works by road vehicle.

Prices for October-May delivery will be announced later; and it is the intention, subject to the approval of the Boards of Agriculture, to grade them on a rising scale which will give a substantial advantage to those who take early delivery.

### Circular of the Board of Agriculture.

The Board of Agriculture have courteously supplied us with a copy of a circular-letter on the same subject which they have addressed to sulphate of ammonia makers. The particulars and prices contained in this document are the same as those given in the foregoing.

Attention is drawn to the fact that the Equalization Committee undertake to reserve a quantity of 40,000 tons for home agriculture in the period June-September, 1919. It is estimated that the total production in the same period may amount to 108,000 tons; and the Board will be prepared to recommend the issue of export licences in respect of the quantity not required for home use. The agricultural requirements for the whole season 1919-20 are estimated at present at 200,000 tons.

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**Gas-Works Fatality.**—An inquest has been held at Coleraine into the cause of the death of Francis M'Laughlin, aged 32, who expired suddenly while engaged in cleaning-down a portion of the top of the retort-bench at the local gas-works. Mr. John Taylor (the Manager) said he noticed M'Laughlin in a sitting position, and, believing that something had gone wrong, sent the foreman and stoker, who found him in an unconscious condition, and brought him down. It was stated that the temperature at the time was normal, and that there was no smell of gas. Dr. T. J. Creery deposed that when he arrived on the scene death had occurred; and he thought it was due to some form of gas poisoning. A verdict to this effect was returned.

**Gas-Workers' Hours at Airdrie.**—At a meeting of the Airdrie Town Council on the 5th inst., the Gas Committee reported that the application by the boilermen in the works for shorter working hours had been dealt with. A communication was read from the Separate Committee of Gas Employers intimating that, in conference with the National Federation of General Workers, it had been agreed that the hours of workmen, other than shift workers, should be reduced to 47 per week, with no reduction in the nominal rate of weekly pay. In the case of shift workers, the hours would continue as at present; but that the rate per shift should be increased by 6d. The Committee, after discussion, instructed the Manager to give effect to this agreement; and the Council approved.

## SOUTH BARRACAS (BUENOS AYRES) GAS COMPANY.

### Coal Substitutes and Decreased Consumption.

A difficult position was revealed in the report of the Directors for the year ended Dec. 31, and by the explanation given at the meeting of shareholders, which was held last Thursday, at the London Offices, No. 1, East India Avenue, Leadenhall Street, E.C.

The Chairman (Mr. J. C. im Thurn) said that the past year had been one of unparalleled difficulty in carrying on the business of the Company. The disastrous state of affairs brought about by the war reached its climax in 1918, with the result that the working for the year showed a debit balance of £24,162, to which had to be added interest on loans and advances £7425, making a total debit of £31,587. Manufacture of gas cost £4526 more than in the previous year, entirely due to the extra cost of poor gas-making materials. Receipts showed a decrease of £13,237, chiefly due to the lack of residuals from the gas-making materials it had been necessary to use. During the period under review, only 106 tons of coal were carbonized; and after February suitable coal was absolutely unobtainable at any price, with the result that gas had to be made from oil, wood (nineteen different classes of which were used), bran, maize, &c., at almost prohibitive prices, which had to be paid in order to keep the business of the Company going. Even these materials were not plentiful; and on more than one occasion the works were completely denuded of all classes of gas-making materials for some hours together. But by a readjustment of pressures in the various districts during these crises, it was possible to pull through. During the year, they had been purchasing gas from the Primitiva Company, so as to keep up the supply; but eventually it was found that their Company were able to manufacture as cheaply as the Primitiva Company, so that at present no supplies were being taken from them. Comparing 1918 with 1914, the cost of oil had increased by 108 p.ct., retort-house tools 300 p.ct., iron piping 267 p.ct., mantles 67 p.ct., &c.; and at that time they were still selling gas at pre-war prices. Strikes had again been a grave source of trouble. The Company had not had trouble with their own men; but there had been frequent strikes at the canning factories, which had resulted in their being closed-down. As these works were very large consumers of gas, there had been a decrease in sales. Last January, a general strike was declared, with the result that their works were invaded by some 600 armed strikers, who turned out the Company's own men, and stated that if the works were not shut-down in half-an-hour they would wreck all the machinery in the place. To this the Company were forced to submit. But beyond the loss of business for four days, no damage was suffered. Coal for export was still unobtainable in this country; but last month a cable was received from their Manager telling them that a purchase of coal from the United States had been effected; and shortly afterwards the Board were advised that by using this coal gas was being made at a price which permitted of a profit being made in South Barracas. Though they had apparently seen the worst of their troubles, they could not look for very sudden improvements, because coal was not yet freely available in the South American market, and all indications pointed to the fact that the return of prices to more normal figures would be a slow process. In September and October, their Manager was successful in raising the price of gas for heating purposes. Some little opposition was encountered; but by showing a bold front, this had died down. Gas for heating and commercial purposes would always hold its own in South America; and there was no doubt that this branch of the business could be increased with a return to normal times. The debts of the Company at the date of the balance-sheet amounted to the very heavy total of £113,813, represented by loans at the bank £50,000, and other moneys raised for the purpose of keeping the business going. When it first became apparent that this state of affairs might ensue, because of the impossibility of making gas at a profit out of such materials as he had indicated, the Directors hesitated for a long time as to whether they should not close-down the gas-works altogether. But they were very strongly advised that such a course would be absolutely fatal to any renewal of the business; and it was this fact that induced the Directors to come forward and support the Company to a greater extent than they had any intention of doing. While the £30,000 first mortgage debenture stock allotted last January (and therefore not appearing in the balance-sheet) had relieved the position to a certain extent, it still left the Company with insufficient funds to carry on the business. The time had therefore now come to reorganize the Company; and the Directors were considering the best method of re-arranging the finances. Mr. W. Upton retired from the position of Secretary in March last. He had been connected with the Company for some twenty years, and had very ably carried out the duties of Secretary since 1910. The Directors were very sorry indeed to lose his services; but for reasons of health it was necessary for him to reside out of London. It was a pleasure to put on record the Board's appreciation of his past services. Mr. M. Denne had been appointed Secretary. The shareholders would have gathered what an arduous and trying time the Manager, Mr. R. B. Brown, had had during the period under review—one trouble being superimposed on another all the year through. Though the working of the Company had been carried on at a loss, they must remember that, but for the energy and resource shown by Mr. Brown, who was ably supported by the Local Committee, it might not have been possible to carry on at all. He therefore wished to express appreciation of the efforts of the Local Committee, the Manager, and his staff during 1918.

The report and accounts were adopted.

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**Reduction in Price at Monifieth.**—A reduction of 3d. per 1000 c.ft. in the price of gas has been agreed to by the Monifieth Town Council, on the recommendation of the Gas Committee. The reduction is from 5s. 8d. to 5s. 5d. per 1000 c.ft., for both ordinary and slot consumers, with the usual 5 p.ct. discount for the former. The Council expressed themselves as being thoroughly satisfied with the results of the year's working.

## RADIATION, LIMITED.

### Gas-Stove Manufacturers' Combine.

For some time past there has been in course of arrangement a union between certain of the principal gas-stove makers; and this has now been completed by the registration, under the title of Radiation, Ltd., of a Company for combining the interests of John Wright and Eagle Range, Ltd., the Richmond Gas Stove and Meter Company, Ltd., and the Davis Gas Stove Company, Ltd. The matter was first alluded to in our columns on March 18, p. 563.

The nominal capital of the new Company is £2,750,000, in 1,350,000 preference and 1,400,000 ordinary shares of £1 each. The preference shares are entitled to a fixed cumulative preferential dividend of 6 p.ct. per annum and take priority in a winding-up both for arrears of dividend and return of capital, but carry no further rights in profits or assets. The principal objects are to acquire all or any of the shares of the Companies named, and any similar companies, and to carry on the business of manufacturers of, and dealers in, gas cooking and heating appliances, stoves, furnaces, and other apparatus employing gas, electrical, coal, coke, oil, or other fuels, manufacturers of, and dealers in, gas and electric appliances of all kinds, &c. When the union of interests is completed, the issued capital of the new Company will be £1,576,615, of which £1,007,575 will be ordinary shares and £569,040 will be 6 p.ct. cumulative preference shares.

The first Directors of the new Company are:

Mr. H. JAMES YATES (Chairman and Managing-Director), Chairman and Managing-Director of John Wright and Eagle Range, Ltd.

Mr. G. G. BRODIE, Managing-Director of John Wright and Eagle Range, Ltd.

Mr. J. F. DAVIES (Managing-Director), Director of John Wright and Eagle Range, Ltd., and General Manager of the Gas Stove Works of that Company.

Mr. W. BRODIE, Director of John Wright and Eagle Range, Ltd.

Mr. T. B. PEATTIE, Director and Secretary of John Wright and Eagle Range, Ltd.

Mr. EDWARD MARKWICK, Manager of the Eagle Range Works of John Wright and Eagle Range, Ltd.

Mr. J. A. JORDAN, Managing-Director of J. A. Jordan and Sons, Ltd.

Mr. JOHN COXON, Chairman of the Richmond Gas Stove and Meter Company, Ltd.

Mr. H. M. THORNTON (Managing-Director), Vice-Chairman and Managing-Director of the Richmond Gas Stove and Meter Company, Ltd.

Mr. THOMAS DWERRYHOUSE, Director of the Richmond Gas Stove and Meter Company, Ltd.

Mr. J. W. SLACK (Managing-Director), Managing-Director of the Richmond Gas Stove and Meter Company, Ltd.

Dr. J. F. ATKINS, Director of the Richmond Gas Stove and Meter Company, Ltd.

Mr. H. ADDIS PRICE, Chairman of the Davis Gas-Stove Company, Ltd.

Mr. HAROLD N. DAVIS (Managing-Director), Managing-Director of the Davis Gas-Stove Company, Ltd.

Mr. CYRIL G. DAVIS (Managing-Director), Managing Director of the Davis Gas-Stove Company, Ltd.

During the first five years, John Wright and Eagle Range, Ltd., may be represented by such number of Directors as shall give them one vote more than the votes of all the other Directors. During the second five years the Richmond and Davis Companies may be represented by such number of Directors as will give the Directors appointed by those two Companies a majority of one vote over the other Directors. For the purpose of this arrangement, a Chairman, entitled to a casting vote, shall be reckoned as having two votes.

For the convenience of working, and in order to save considerable expense, it has been decided that the fusion shall take the form of an exchange by the individual shareholders of their ordinary shares for preference and ordinary shares in the new Company. In order to ensure equality of treatment as between the holders of shares in the three Companies, the terms on which it is proposed to buy the holdings in the amalgamating Companies have been determined by Messrs. W. B. Peat and Co., of London and Birmingham.

In a circular-letter to their shareholders giving details of the scheme, Mr. T. B. Peattie, the Secretary of John Wright and Eagle Range, Ltd., says the Directors are more than ever convinced that such a union of interests is essential in view of various considerations named in an earlier circular—viz., the unexampled difficulties with which manufacturing concerns are at present faced, the substantial economies expected to result from the elimination, as regards the three businesses, of those great competitive outlays incidental to the trade in which they are engaged, the avoidance of duplication in the heavy costs of manufacture, the benefit of mass production and standardization of apparatus in increased output and diminished cost of production, and the minimizing, as far as possible, of rises in selling prices.

The qualification of a Director is 500 shares, and the remuneration (except a Managing-Director), £250 each per annum, free of income-tax, and £500, free of income-tax, for the Chairman.

The registered office is at No. 18, Bennett's Hill, Birmingham.

**Maximum Price at Loughborough.**—The Town Clerk stated at the last meeting of the Loughborough Town Council that the maximum charge for gas at present was 3s. 6d. per 1000 c.ft.; and the Gas Committee proposed asking the Local Government Board for power to raise it 2s. The Board would only allow such increase as would cover the increased expenditure. They must not take it that the price would be raised 2s. Alderman R. S. Clifford asked how their price compared with that charged at Nottingham. He had read in the newspapers that the Nottingham Gas Committee had been able to hand over a large sum to the relief of the rates. It seemed remarkable that they could not make both ends meet at Loughborough.

## BRISTOL AND THE COAL SITUATION.

### An Interview with the Chairman of the Gas Company.

Interviewed by a representative of the "Bristol Times and Mirror," Mr. J. H. Howell, the Chairman of the Bristol Gas Company, explained the extent to which the undertaking has been affected by the enormous rise in the price of coal and by the difficulty in procuring it.

The Company have, he said, 69,000 meters and over 58,000 cookers in use; and they carbonize from 250,000 to 300,000 tons of coal per annum. This coal normally was obtained principally from the Gloucestershire and Somerset coalfields, and from South Wales, the Forest of Dean, Nottinghamshire, and Derbyshire. Whereas in 1913 coal cost them on an average 14s. 10d. per ton, in 1918 it cost 29s. 6d.; and though the Company carbonized about 32,000 tons less last year than in 1917, the extra cost for 1918 was £21,000. When the late Sir Guy Calthrop became Coal Controller, he cancelled about 150,000 tons of coal the Company had asked for in Nottinghamshire and Derbyshire, and substituted for it coal from Durham, at an extra price per ton, and an exaggerated cost for transport—a striking illustration, added Mr. Howell, of the inscrutable methods of official control.

In consequence of extra costs, the price of gas has gone up from the pre-war figure of 2s. per 1000 c.ft. to 3s. 3d. at the present time. Every shilling a ton advance in the cost of coal is the equivalent of 1d. per 1000 c.ft. of gas; so that if coal is advanced 4s. 6d. per ton, in all probability with extra costs that will also be incurred, the price of gas will go up another 5d. or 6d. per 1000 c.ft.

Discussing the question of nationalization, Mr. Howell declared his conviction that "any attempt to nationalize coal would end in utter disaster; and, inasmuch as Sir Auckland Geddes says our exports of coal, which were 77 million tons in 1913, must be now cut down to 23 millions, it would be ruinous to our exchanges, and would impose upon the consumer of all commodities an extraordinarily high charge for everything he had to purchase."

## STOCKPORT GAS UNDERTAKING INVESTIGATION.

### The Committee's Report.

At the last monthly meeting of the Stockport Town Council—the MAYOR (Mr. T. Rowbotham) presiding—there was submitted the Gas Committee's report upon the recommendations made by Mr. W. Doig Gibb, who recently investigated the working of the gas undertaking. The main portions of Mr. Gibb's report were given in the "JOURNAL" for April 8 [p. 106].

After his report had been sent in, Mr. Gibb attended a meeting of the Committee, and fully discussed with the members the matters with which he had dealt. As to the proposed new carbonizing plant, he impressed upon the Committee his strong views that it would be desirable for them to approach this subject *de novo*, and that it would be advisable for the Engineer (Mr. S. Meunier) to obtain statistics on the working of vertical retorts during the past four or five years, and compare these figures with other systems. The Committee agreed that in view of the developments and changes since 1914 this matter would require an absolutely fresh start. It was resolved that the Engineer be instructed to submit a scheme for a new carbonizing plant, having special regard to the recommendations made by Mr. Gibb; and that he obtain statistics of the working of vertical retorts for the past four or five years, with estimates of the cost of installation.

It was decided that steps be taken to obtain the services of a foreman to have charge of the carbonizing plant; and that a Special Sub-Committee be appointed to interview the Engineer and the Assistant Engineer, with regard to a strict allocation of duties among the staff on the works. Further, it was resolved, in accordance with Mr. Gibb's recommendation, that an Accountant be appointed. Various other matters referred to in Mr. Gibb's report were amplified by him at the meeting.

The adoption of the Gas Committee's minutes was moved by Mr. Welsh (the Chairman); and a long discussion ensued, mainly with reference to the proposed appointment of a Secretary and Accountant, and the exact position this official would occupy. In the end, the minutes of the Committee were passed.

## BARROW CORPORATION GAS-WORKS.

The annual report of Mr. F. Chadderton, the Manager of the Barrow gas undertaking, and the report upon the financial results by Mr. W. W. Waite, the Borough Treasurer, resulted in a proposal at the Barrow Town Council meeting on the 2nd inst. that the price of gas should be reduced from 4s. 6d. to 4s. per 1000 c.ft., and an ultimate decision that consideration should be further deferred until the July meeting, so that each member of the Council could be furnished with copies of the two reports.

Mr. Chadderton points out that 28,750 tons of coal and cannel were used last year, as against 31,653 tons in the previous year; and that of oil there were used 374½ tons, against 689 tons. The gas made totalled nearly 385 million c.ft., as compared with 360 millions for the year before; while the carburetted water gas made was 54 million c.ft., against 81 millions. The decrease in the amount of gas sold was 1,792,000 c.ft. During the early part of the year the consumption of gas was showing an increase on the previous year's working; but in November it dropped, and the falling off has steadily continued. The unaccounted-for gas has decreased to 6·89 p.ct. The make of gas per ton of coal carbonized shows a distinct improvement; the average for the year at the branch works at Salthouse being 1000 c.ft. per ton of coal more than was guaranteed by the patentees of the plant.

The Treasurer's report shows that the net profit for 1918-19 was

£9482, against a net loss of £4846 in 1917-18. The results, says Mr. Waite, raise the point that the gas profit of £9482 is somewhat more than was probably anticipated when the price was raised from 4s. to 4s. 6d. per 1000 c.ft., in October last. The price at April 1, 1918, was 4s per 1000 c.ft.; and this was increased to 4s. 6d. from Oct. 1. So that the average price per ordinary meter works out at 4s. 3d. per 1000 c.ft. for the year, as against an average of 3s. 3d. for the preceding twelve months. The consumption has decreased since the armistice, and at present is about 25 p.ct. less than a year ago. This is a very serious reduction in output, and requires attention, with a view to increasing the general consumption, so as to compensate for the loss of supplies for munition work. The position is undoubtedly the aftermath of having to disturb many pre-war consumers by disconnecting their cooking supplies, and altering the constitution of the gas delivered to comply with Government requirements. Efforts should be made to retrieve the position by bringing the improved conditions in which they were now placed prominently to the notice of consumers, and by encouraging in every way possible increased consumption.

The improvement in carbonizing results at Barrow was referred to in last week's issue, p. 706, when it was stated that "in the last twelve months there had been more gas produced per ton of coal carbonized than in the previous year." In this connection it is of interest to note that the plant responsible for such good work is the "Dempster-Toogood" system, of Messrs. Robert Dempster & Sons, Ltd., of Elland; and the figures support the editorial comments in last week's "Journal," p. 692, on the "Collection of Data."

## CURRENT SALES OF GAS PRODUCTS.

### The London Market for Tar, Tar Products, and Sulphate.

London, *June* 16.

There is no alteration in the position of pitch. Demand continues good and the price is quite firm at not below 65s. per ton net at makers' works. In other products, the values are as follows: Creosote, 5½d. to 6d. per gallon in bulk; toluol, 2s. 9d. to 3s. per gallon filled into buyers' packages; solvent naphtha, 2s. 3d. to 2s. 4½d. per gallon filled into buyers' packages; anthracene, 48-50 p.ct., 7d. to 8d. per unit, casks free; pyridine bases, 4s. to 4s. 3d. per gallon filled into buyers' drums; crude carbolic acid 60's, about 1s. per gallon net, casks free.

In sulphate of ammonia, there is nothing new to report.

### Tar Products in the Provinces.

*June* 16.

The average values for gas-works products during the week were: Gas-works coal tar, 34s. 6d. to 39s. 6d. Pitch, East Coast, 56s. to 58s. 6d. per ton f.a.s.; West Coast—Manchester 48s. to 50s.; Liverpool, 48s. to 50s., Clyde, 55s. to 57s. 6d. nominal. Benzol 90 p.ct., North, 1s. 8d. to 1s. 10d.; crude, 65 p.ct., at 120° C., 11d. to 1s. naked at makers' works; 50-90 p.ct. naked, North, 1s. 8d. to 1s. 10d. Toluol, naked, North, 2s. to 2s. 1d. nominal. Coal tar crude naphtha in bulk, North, 7¾d. to 8¼d. Solvent naphtha, naked, North, 1s. 9d. to 1s. 11d. Heavy naphtha, North, 2s. 3d. to 2s. 5d. Creosote in bulk, North, liquid, 5d. to 5¼d.; salty, 4¼d. to 4¾d. Heavy oils, in bulk, North, 6d. to 6¼d. Carbolic acid, 60 p.ct., unsaleable. Naphthalene, £16 to £18; salts, £5 to £6, bags included. Anthracene "A" quality, 7¼d. to 7½d. per minimum 40 p.ct.; "B" quality, nominal.

## FROM A MARKET CORRESPONDENT.

### Tar Products.

The demand for the more important bye-products seems to be increasing. Pitch particularly is in steady request, with a likelihood of prices hardening still further. The shipping trade is practically at a standstill now, on account of the hot weather; but makers are booking orders for next season at a premium upon late rates. The home road-making demand, however, is preventing any large accumulations of stocks in the meantime. Reports from many districts indicate that this work is in full swing. Prepared tars are in keen demand. Solvent naphtha keeps on the weak side; and there seems no prospect of early change for the better. Heavy and crude are without change. Carbolic acids are still flat. Curiously enough, from far-off Japan comes news of a recent slump; but prices were improving when the last mail left. Benzol is being well absorbed; local customers still taking fair quantities of the makers' outputs. Ireland is becoming an increasingly large customer. Toluol is firm. Naphthalenes are dull, and lower. Other products are without material change.

The range of home quotations is as follows:

Benzol: 90% London 2s. to 2s. 2d., North 1s. 11d. to 2s.; 50-90% 1s. 9d. to 2s. London, 1s. 9½d. North; crude 60-65% 1s. 3½d. to 1s. 5½d.; pure, 3s. per gallon naked.

Carbolic Acid: Crude 60's unsaleable; crystals 40%, 4d. per lb. asked.

Crude Tar: London, 44s. to 46s.; Midlands, 40s. to 42s.; North 40s. per ton *ex* works.

Pitch: London, 67s. 6d. to 70s. per ton; East Coast, 54s. to 56s. per ton, West Coast, 48s. to 50s., with Manchester 48s. 9d. per ton and Glasgow 50s. per ton; South Wales, 56s. to 58s. per ton.

Solvent Naphtha: London, 2s. to 2s. 1d. Provinces average 2s. per gallon.

Crude Naphtha: Naked, 10d. per gallon.

Heavy Naphtha: 2s. 3d. per gallon.

Naphthalene: Refined, £15 to £17 per ton nominal; crude, £3 10s. to £8, according to quality.

Toluol: Naked, 2s. 9d. per gallon nominal. North 2s. 7d.


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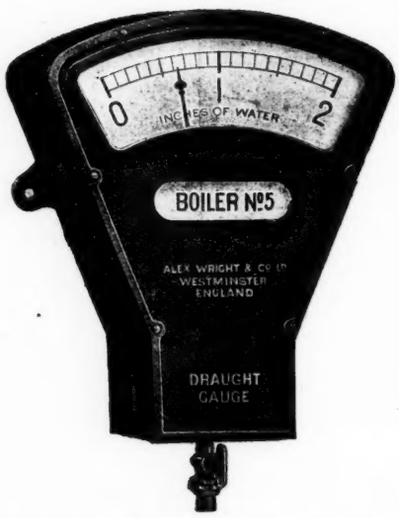


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MADE IN MANY RANGES WITH TABLETS LETTERED AS DESIRED.

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Agents: Australia—FYVIE & STEWART, 360, Collins St., Melbourne; Canada—W. P. ROPER, 502, Merchants' Bank Building, Montreal.

**Creosote:** London, 7¾d.; North, 6¾d. to 7d.; heavy oil, 7¼d. per gallon in bulk.
**Anthracene:** 40-45%, 6d. to 8d. per unit per cwt.
**Grease Oils:** 18° Tw. (naked), £6 10s. per ton f.o.r. makers' works.
**Aniline Oil:** 1s. 2d. per lb.
**Cresylic Acid:** 95%, 2s. 9d. to 2s. 10d.; 97-99%, 2s. 11d. to 3s. 3d. *ex* works London, f.o.b. other ports.

### Sulphate of Ammonia.

In spite of all the hopes and anticipations—not to mention the confident predictions—there seems to have been very little alteration in the position of sulphate of ammonia, which is not yet free for export. Arrangements have been made for the product to be sold through the recognized channels until the end of May, 1920. The demand for small parcels for home consumption is very great, and in some cases merchants' stocks are quite depleted. Prices now being quoted for export trading are very irregular—varying, of course, according to destination. Quotations ranging from £25 to £30 per ton, net cash, f.o.b. British port have reached me. At the same time, it must be pointed out that in other quarters a figure as low as £20 for export has been mentioned. This wide variety of prices quoted for overseas consignments is very largely accounted for by the facts that export is still only permissible under licence, and there is very little available for shipment at the moment, owing to the home demand absorbing the bulk of the output. South Wales seems likely to play an important part in the future of this fertilizer, and colliery owners and others who have erected bye-product plants are doing all in their power to promote shipping business. I hear that there is a scarcity of sulphate in Mexico at the present time; the trade having been in the hands of German makers before the war. It is necessary for shipments to reach Mexico not later than July in order to be of benefit for the sugar and tobacco crops of the coming season. Manufacturers and exporters of sulphate (also of potash and superphosphate) can obtain interesting information on this field on application to the Department of Overseas Trade, 73, Basinghall Street, E.C.2.

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The Kirkintilloch Gas-Works produced in the past twelve months 93,406,000 c.ft. of gas from 7184 tons of coal. The average make of gas per ton of coal was 13,000 c.ft. Wages increased by 34·17 p.ct., and coal by 21·1 p.ct.

Messrs. Bale and Hardy, Ltd., of No. 39, Victoria Street, S.W., have received orders for Tully's carburetted hydrogen plants for Llandudno (capacity 306,000 c.ft. per day), Normanton (200,000 c.ft.), and Enniskillen (50,000 c.ft.).

The Monte Video Gas Company, Ltd., notify that the transfer books of the 5 p.ct. perpetual first mortgage debenture stock will be closed from the 17th to the 30th inst. inclusive, for the preparation of the interest warrants payable on July 1.

**Dunfermline Gas Price.**—The deficit on the year's working in Dunfermline is £6607; and ex-Provost Harley, at a meeting of the Town Council, estimated that the price of gas in the city would require to be increased by 8d. per 1000 c.ft. A large part of the deficit had been due to the fire at the gas-works; while the cost of repairs and alterations had been exceptionally heavy.

**Continuous Vertical Retorts for Galashiels.**—The Directors of the Galashiels Gaslight Company, under the advice of their Engineer (Mr. Alex. Dow), have placed the order for an installation of the Dempster-Toogood system of vertical retorts. The plant will replace a section of the horizontal carbonizing plant; and a portion of the present horizontal retort-house will be raised. The coal-handling plant will be on the most approved lines, and a hoist will be provided for the handling of coke and for giving general access to the plant.

**Vertical Retorts for Inverness.**—It has been decided to instal vertical retorts at Inverness. The motion for approval of the Committee's report at the Town Council meeting was carried by 11 votes against 10 for an amendment to call in a consulting engineer. It was pointed out that the price of gas is 5s. 5d. per 1000 c.ft., as compared with 2s. 11d. before the war. After two years' working of this new system of vertical retorts, it was stated, gas could be produced at 3s. 9d. per 1000 c.ft. The capital outlay would be £24,000; and this would bring about a saving of £3000 a year.

**Ballymena Gas-Works.**—The Ballymena Urban District Council postponed for a special meeting the question of obtaining a Provisional Order to enable the price of gas to be increased, and to secure power for constructing buildings and manufacturing and storing gas on lands outside the present scheduled premises or lands. Mr. H. Lancashire, J.P. (the Chairman), said they must realize that they could not go on supplying gas at the present price, for they were selling at a figure much below the cost of manufacture. Mr. Henry pointed out that they were putting in retorts at a cost of from £15,000 to £16,000, and there were other important public works on hand; so that the ratepayers had enough to do.

**Gas Matters at Drogheda.**—At a meeting of Drogheda Corporation, a statement of the financial position of the gas-works showed a debit balance of £1057. The Local Government Board for Ireland wrote, with reference to the Council's application for permission to increase the maximum price of gas to 6s. 6d. per 1000 c.ft., that they were not satisfied that any serious attempt had been made to restrict the cost of unloading and transference of coal from the quay to the Corporation stores, although attention had been frequently directed to the matter by the Auditor. In the circumstances, approval could not be given to the application. It was reported that the stokers going out in sympathetic strike in connection with local labour disputes led to numerous industries being seriously interfered with. All the troubles have now been amicably arranged.


# Gas and the Housing Problem.

PENDING the necessary provision of new houses, the best has to be made of existing accommodation. The essential economy of space is secured by the use of the ideal Cookers in present circumstances — Main's "Kent," "Sussex" and "Surrey." These efficient and compact cookers embody all recent improvements and are designed with a view to securing the minimum cost for maintenance.

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**Drogheda Gas-Workers' Strike.**—The stokers at the Drogheda Gas-Works, who had gone on strike on a "sympathetic" wages issue, resumed work on being served with notices that the Corporation intended to prosecute them. They went out, however, a second time; but in the end the strike collapsed—the Corporation refusing to consider any terms.

**Gas Supply to Luddenden Foot.**—At the last meeting of the Luddenden Foot District Council, a letter was read from the Sowerby Bridge District Council asking if Luddenden Foot would be willing to consider entering into negotiations with a view to purchasing the gas-works which are situate at Luddenden Foot. The Chairman of the Council (Mr. A. E. Waters) considered that this was really no reply to their complaints; and it was decided not to discuss the question of purchase until Sowerby Bridge made a satisfactory response to the Council's request for a better quality and a higher pressure of gas.

**Ticehurst District Council and the Gas Company.**—There was some discussion at a meeting of the Ticehurst Rural District Council with reference to correspondence concerning complaints of the quality of the gas supplied at Ticehurst by the Wadhurst Gas Company, and also on the point whether the charge of 8s. 9d. per 1000 c.ft. could be legally made before the Board of Trade sanction to the increase was intimated. A number of gas consumers at Ticehurst wrote asking whether the Board of Trade could be approached with the suggestion that a rebate of the additional charges made could be obtained. Mr. Reeves said the Ticehurst residents complained that the seven days' notice given by the public announcement of the increase was too short a time to allow objections to be prepared. The Gas Company wrote stating that they had had no complaints of the quality of the gas, and asking the Council on what grounds they made their objections. It was decided to reply that the objections were made on information given by representatives of Ticehurst on the Council.

**Gas-Works Extensions at Bury.**—The Bury Town Council have agreed to the recommendation of the Gas Committee to apply to the Local Government Board for sanction to borrow £40,000 (in lieu of the sum of £35,000 already applied for), in respect of extensions and improvements to the carbonizing plant at the gas-works; and also for the sum of £6000 for the purchase of meters and cookers, and £4000 for mains. Alderman S. Kay (the Chairman of the Gas Committee) states that the vertical system of carbonization is now regarded by the most eminent members of the gas profession as being the best and the most economical method of producing gas; and the results obtained at other works where the system has been adopted are sufficient to warrant the Committee proceeding with the work as quickly as possible. Had the war not come along and put a stop to work of this description, in all probability Bury would have had a vertical installation already at work. It is essential, he adds, that the Committee should have money to purchase new meters, as the amount of unaccounted-for gas has grown considerably during the past few years—largely due to incorrect registration of consumers' meters.

**An Illegal Gas Connection.**—At Halifax, on Friday, Bates Mitchell, of Bradshaw, was fined £2 (the penalty being small in consideration of his former long service with the Corporation Gas Department) for making a connection with the gas-pipe at his house, as a result of which the gas did not pass through the meter. The defence was that he had made the connection only on the morning it was discovered. He did not intend to get gas without payment, but wished to dissolve the naphthalene deposited in the pipe, which was preventing a proper flow of gas. He admitted that he ought to have secured permission to make the connection.

**Gas-Mantle Makers and the Excess Profits Duty.**—It is reported that, upon the application of the Gas-Mantle Manufacturers' Association, an Order has been made by the Commissioners of Inland Revenue increasing the statutory percentage upon which the pre-war standard of profits is based for the purpose of assessing excess profits duty in the case of "the business of manufacturing incandescent gas-mantles with or without the manufacture of the requisite salts of the rare earths." The statutory percentage is increased in the case of a company to 9 p.ct., and, in the case of any other business, for accounting periods ending prior to Jan. 1, 1917, to 9 p.ct., *plus* 1 p.ct.; and for accounting periods ending after Dec. 31, 1916, to 9 p.ct., *plus* 2 p.ct., with certain exceptions.

**Employees as Shareholders.**—The shareholders of the Staveley Coal and Iron Company, Ltd., have approved a scheme for enabling employees to invest in the Company on favourable terms. It is explained that the preference shares, amounting to £25,000, are to be converted into £1 ordinary shares and offered to members of the staff and workmen at 30s. each, which is 8s. below the market price of the present ordinary shares. All the preference shares have been acquired by the Chairman (Mr. Charles Markham) with a view to the carrying out of this arrangement; and he will pay the premium to the Company. It is proposed to place the allotment of the shares in the hands of a Committee, on which two prominent leaders of the men's unions will be asked to serve. In order to prevent profiteering, it will be stipulated that the shares must not be sold, except in case of necessity, for two years.

**Income-Tax Assessment at Airdrie.**—An adjourned meeting of the Airdrie Corporation Gas Committee has been held for the consideration of an appeal which had been lodged against the income-tax assessment on the undertaking. The Committee, having fully discussed the matter, reported to the Town Council that they were unanimously of opinion that the principle of allowing depreciation on machinery and plant, in place of actual renewals when incurred, was the proper basis in arriving at the deductions to be allowed in filing the income-tax assessment; but as it was the intention of the Committee to proceed with the installation of new retorts at the earliest possible date, it was agreed that the appeal against the present assessment should be withdrawn. The Committee asked that the Town Council should remit to them to consider the question of proceeding at once with the erection of new vertical retorts, and to obtain estimates for the work.

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FOR "JOINT USE" WITH COAL GAS.

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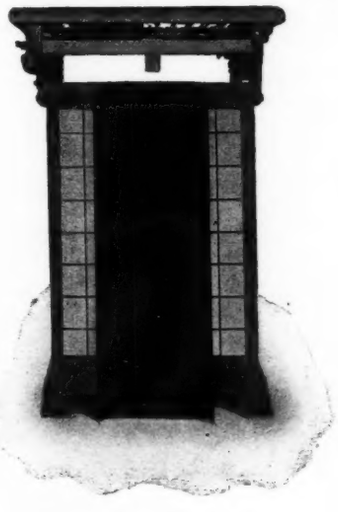
## for GAS COOKERS, BOILERS, &c.



Back View.

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**No. 5.** No troublesome down-draught to extinguish the oven flames.

**No. 6.** No excessive up-draught to draw away heat out of oven.

**No. 7.** No smell of cooking noticeable at breathing level.

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Side View.

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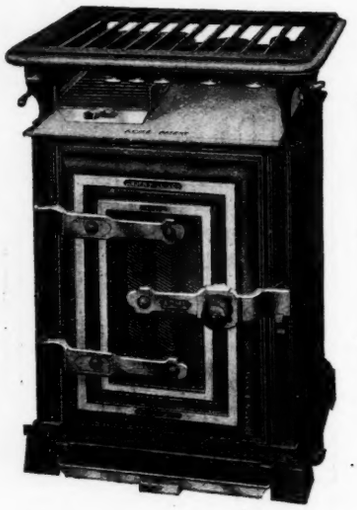

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*Full particulars of Sizes and Prices on application to the Makers.*

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**(with Thermostat)**

An entirely new Circulating Boiler—the latest in scientific Circulator design and construction.

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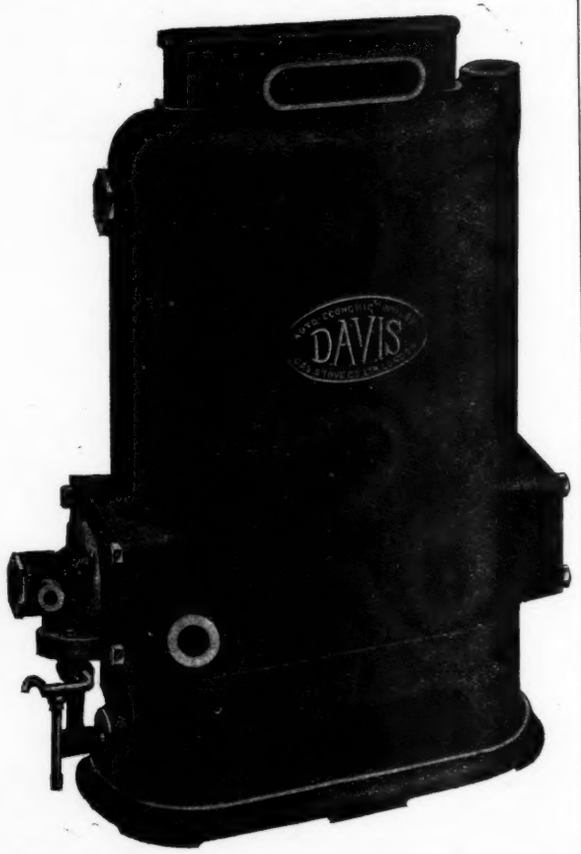
**Easy to Clean and Maintain**
**Inexpensive as to First Cost**

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**The Davis Gas Stove Co., Ltd.,**
**60, Oxford Street, London, W.1.**

## Leek District Council Gas-Works Report.

Mr. R. H. Ginman, the Engineer and Manager, has presented his fifth annual report and analysis of accounts to the Lighting Committee of the Leek Urban District Council. The period covered is the year ended March 31, during which 9000 tons of coal were carbonized, with a make of 134,191,000 c.ft. of gas. The quantity accounted for was 124,700,000 c.ft., or 13,855 c.ft. per ton of coal; the leakage being 7·06 p.ct. As a matter of fact, with 700 tons less coal used, there was an increase of 74,000 c.ft. in the quantity of gas made. The increase in the amount of gas accounted for per ton of coal, as compared with the previous year, was 922 c.ft. The result of the working was a gross profit of £1865, and a net loss of £448, which compared with a net profit of £1640 for the previous twelve months. His analysis, Mr. Ginman says, shows the working results obtained in 1919 to be the highest in the history of the undertaking. The net cost of coal, after deducting receipts from residuals, was 15s. 7d. per ton, against 11s. 7d. in 1917-18. In 1910 the net cost of coal was 5s. 6d. per ton, wages were £2938 less, and gas was 2s. 6d. per 1000 c.ft., as compared with 2s. 10d. in 1918-19. Taxes in 1910 were £330, against £1868 last year. It will, Mr. Ginman remarks, be obvious, after considering his report, that a substantial increase in the price of gas must take place from the June readings of consumers' meters. He considers Leek extremely fortunate to have gone as far as they have with their price of gas below that of all neighbouring towns and cities.

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At a local auction sale, a number of "B" shares of £10 each in the Bromsgrove Gas Company were sold at £11 10s. to £11 12s. 6d. each.

After considering tenders for the erection of vertical retorts on the site of their No. 5 retort-house the Burton-on-Trent Gas Committee resolved that the tender of Messrs. R. Dempster & Son, Ltd., of Elland, Yorks, at the sum of £65,500, be accepted.

Mr. W. E. Stapleton has resigned his position as Director and General Manager of Messrs. D. Hulett & Co., Ltd. He has been connected with the firm for some thirty-six years, having entered their service as a lad of fifteen, and during the past twenty years has acted as General Manager.

There is still some space available in the exhibition to be held in October and November next in Athens, under the auspices of the Federation of British Industries. This exhibition, it is pointed out, will give firms in this country an exceptional opportunity of introducing their goods to Greek buyers in advance of manufacturers of other nationalities. Fertilizers and chemicals generally are among the articles mentioned by the Federation's Special Commissioner in Athens as being greatly in demand.

Mr. T. B. Shore, who has been Manager and Director of the Considere Construction Company, Ltd., since its formation in 1908, has severed his connection with the Company and joined the Board of Sir William Arrol & Co.. Ltd., as a Director. It is the intention of the firm to develop their business in the design of reinforced concrete work in all its branches, and to extend the outside construction organization. Mr. Shore will control, and be responsible for, this department of Messrs. Arrol's business.

A match played at Leeds last Saturday week between the Sheffield Gas Company's Cricket Club and an eleven of the Leeds Corporation Gas Department (captained by the Engineer, Mr. C. S. Shapley), resulted in a win for Sheffield, on drawing time, by the narrow margin of four runs. A repast at the Hotel Metropole was followed by an excellent programme of musical and other items, under the chairmanship of Mr. Shapley. In formally welcoming the visitors, Mr. Shapley spoke of his previous connections with the Sheffield Gas Company.

## APPLICATIONS FOR PATENTS.

**[Extracted from the "Official List" for June 12.]**

Nos. 13,873—14,561.

ANDERSON, D.—"Radiants for gas-fires." No. 13,901.
ANSLOW, D., E., & P. T.—"Method of producing gas joints, &c." No. 14,491.
BARNARD, E.—"Gas-cookers." No. 13,953.
BARRATT, W.—"Atmospheric gas-burners." No. 14,345.
BOWER, C.—"Gas-valves." No. 13,950.
COKE AND GAS OVENS, LTD.—"Coke and gas ovens." No. 14,459.
DICKENS, C.—"Upright incandescent gas-mantles." No. 14,072.
DUDBRIDGE, J. T.—"Alarm device for meters, &c." No. 13,961.
FALK, STADELMANN, & CO.—See Barnard. No. 13,953.
FOX, T.—"Bunsen incandescent mantle lamp burners, &c." No. 13,927.
FOX, T.—"Prepayment mechanisms for meters, &c." No. 14,102.
GAUNT, C. F.—"Furnaces for heat treatment of metals." No. 14,517.
GIBBONS BROS.—See Gaunt. No. 14,517.
GROUNDSTROEM, E. A.—"Gas-producers." No. 14,475.
GUNDERSON, R.—See Coke. No. 14,459.
HARDY, A.—"Furnaces for heat treatment of metal articles." No. 14,245.
HARPER, W.—"Producing and burning gaseous mixtures." No. 14,196.
HUNT, J. H.—See Hardy. No. 14,245.
LYMN, A. H.—"Generation and utilization of producer gas." No. 14,121.
MARLE, M. VAN.—See Gaunt. No. 14,517.
RAMBUSH, N. E.—See Lymn. No. 14,121.
ROBINSON, S.—See Fox. Nos. 13,927, 14,102.
SMITH, D. J.—"Gas-producers." No. 14,214.
SNELL, C. SCOTT-.—See Anderson. No. 13,901.
WALTER, C. M.—See Gaunt. No. 14,517.
WIGGLESWORTH, M.—See Hardy. No. 14,245.
WINTERFLOOD, B. W.—"Geysers, &c." No. 14,185.


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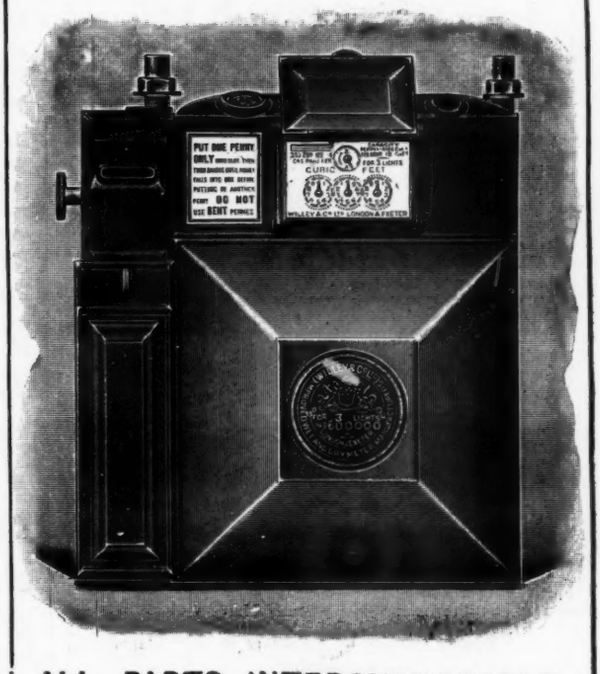


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## STOCK MARKET REPORT.

THE Stock Exchange after the Whitsun holiday reopened very sluggishly on Tuesday, and markets for the most part continued to be quiet, maintaining a waiting attitude in expectation of the Victory Loan prospectus, which was published on Friday. As to this, suffice it here to record that its terms were generally regarded as attractive enough to warrant the forecast of its proving a success.

Into the gilt-edged market, the new Loan came as a disturbing intruder, and upset Home Government issues completely. Naturally the chief sufferers were those excluded from any conversion rights. Consols dropped to 52, but partially recovered later to 53⅜. The 5 p.ct. Loan fell and rose again on a minor scale. Indian and Colonials were lowered, and even Bank of England stock (which, of course, is not a Government security) had a rather heavy fall. Home Rails were quiet and dull. Canadians shaped a little better; but Argentines showed weakness.

In the Foreign Market, French initiated a promising recovery, but failed to maintain it, and gave way again, and Russians recoiled in the face of the many distracting factors which afflict that unhappy land.

The Miscellaneous Market appeared to have achieved the greatest activity, and presented the most cheerful features. Shipping shares were in high favour, and had a very successful week. Insurance concerns and Breweries also did fairly well; but Rubber had a dull time, and Oils were somewhat checked by realizations.

Business in the Gas Market was almost at its very lowest pressure—about 50 p.ct. of what might be taken as a moderate average. Of the very limited number of issues which were dealt in at all, fully two out of every three had but a single transaction, and even Imperial Continental and Primitiva, which have lately been engrossing most of the business, relapsed into comparative quietude. The former was rather easier, marked prices being below those of the week before; but the quotation was left untouched. Primitivas were quite steady. Metropolitans and Suburbans were unchanged, except for *ex div.* adjustments. North Middlesex 10 p.ct. comes into quotation. The quotations of the European and Cape Town Companies were advanced.

Bargains done for cash during the week were as follows: On Tuesday, Bombay 6⅜, British 30⅜, Gas Light ordinary 60¼, 60½, 61, ditto maximum 55½, ditto preference 71, Imperial Continental 142½, 143, 143½, 144, Metropolitan of Melbourne 94¼, Primitiva preference 67s. 6d., 68s. 0d., 69s. 4½d., 70s., South Metropolitan 61¼, 61½, Southampton 67⅞, Wandsworth Epsom 71½. On Wednesday, Alliance and Dublin 62½, Commercial 4 p.ct. 62, Gas Light ordinary 60, ditto preference 71, ditto debenture 57½, Imperial Continental 142½, 143, 143¾, Primitiva 38s., ditto preference 66s. 3d., 68s. 1½d., South African 13⅛, South Metropolitan 61. On Thursday, Gas Light ordinary 60¼, 60½, ditto preference 71, Imperial Continental 142, 142½, 142½, 143, North Middlesex 10 p.ct. 13¾, Primitiva 40s., ditto preference 67s. 6d., 68s. 1½d., 69s. 4½d., South Metropolitan 61, South Suburban 78, 78½. On Friday, Bombay 6, Gas Light ordinary 60, 60½, Imperial Continental 141, 141½, 142, 143, Primitiva 38s., ditto preference 67s. 6d., Swindon United "A" 5 p.ct. 65¾.

In the Money Market, rates for short loans were quite easy; but discount held fairly firm. The Bank rate is 5 p.ct., as fixed on April 5, 1917.

### ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

| Issue. £ | Share. | When last Dividend. | Ante-War Dividend & Bonus p.c. | Last Dividend. | NAME. | Closing Prices. July 16, 1914. | Present Prices. | Lowest and Highest Prices of Bargains. |
|---|---|---|---|---|---|---|---|---|
| 182,049 | Stk. | Mar. 10 | 4 | 4% | Aldershot 4 p.c. Pref. | .. | 62—67 | .. |
| 1,551,868 | " | April 8 | 2½ | 2⅞% | Alliance & Dublin Ord. | 59—64 | 56-60 | 62½ |
| 274,000 | " | July 10 | 4 | 4% | Do. 4 p.c. Deb. | 76—79 | 61—63 | .. |
| 280,000 | 5 | April 29 | 7½ | 8% | Bombay, Ltd. | 5⅞—6⅜ | 6⅜—6½ | 6—6 3/16 |
| 50,000 | 10 | Feb. 26 | 16 | 12% | Bournemouth Gas and Water { 10 p.c. | 20—30 | 20—22 | .. |
| 383,110 | 10 | " | 7 | 7% | B 7 p.c. | 15—15½ | 10½—11½ | .. |
| 115,000 | 10 | " | 6 | 6% | Pref. 6 p.c. | 13½—14 | 9½—10 | .. |
| 159,740 | — | — | — | 4% | 4 p.c. Deb. | .. | 66—68 | .. |
| 993,045 | Stk. | Feb. 26 | 14 | 37/- | Brentford A Consolid. | 261—266 | 74—77 | .. |
| 734,920 | " | " | 11 | 31/8 | Do. B New | 204—209 | 68—71 | .. |
| 55,000 | " | " | 5 | 5% | Do. 5 p.c. Pref. | 109—111 | 78—83 | .. |
| 221,400 | " | June 11 | 4 | 4% | Do. 4 p.c. Deb. | 91—98 | 64—66* | .. |
| 214,775 | " | Feb. 26 | 11 | 7½% | Brighton & Hove Orig. | 208—218 | 137—142 | .. |
| 244,300 | " | " | 8 | 6⅛% | Do. A Ord. Stk. | 154—159 | 94—99 | .. |
| 988,500 | Stk. | — | 5 | 5% | Bristol 5 p.c. max. | .. | .. | .. |
| 680,000 | 20 | Mar. 26 | 12½ | 10% | British | 44—45 | 30½—31½ | 30⅜ |
| 120,000 | Stk. | June 26 | 4 | 4% | Do. 4 p.c. Deb. Stk. | 88—90 | 64—66 | .. |
| 245,771 | " | " | 4 | 4% | Buenos Aires 4 p.c. Deb. | 85—87 | 50—53 | .. |
| 100,000 | 10 | — | — | — | CapeTown & Dis., Ltd. | 1½—2½ | 5½—5⅝ | .. |
| 100,000 | 10 | — | — | 4½% | Do. 4½ p.c. Pref. | 4—6 | 7—7½† | .. |
| 100,000 | Stk. | June 26 | 4½ | 4½% | Do. 4½ p.c. Deb. Stk. | 70—75 | 62—67 | .. |
| 157,150 | " | Feb. 26 | 5 | 5% | Chester 5 p.c. Ord. | 108—110 | .. | .. |
| 1,518,280 | " | Feb. 19 | 5/9/4 | 80/- | Commercial 4 p.c. Stk. | 106—108 | 62—65 | 62 |
| 580,000 | " | " | 5½ | 26/8 | Do. 3½ p.c. do. | 103—105 | 58—61 | .. |
| 475,000 | " | June 11 | 3 | 3% | Do. 3 p.c. Deb. Stk. | 69½—71½ | 50—52* | .. |
| 300,000 | " | " | 4 | — | Continental Union Ltd. | 76—79 | 48—53 | .. |
| 300,000 | " | " | 7 | — | Do. 7 p.c. Pref. | 115—118 | 70—75 | .. |
| 51,600 | Stk. | Aug. 29 | 14½ | 12½% | Croydon A 10 p.c. | .. | 155—165 | .. |
| 278,400 | — | " | 11½ | 9⅞% | Croydon B and C 7 p.c. | .. | 130—135 | .. |
| 492,270 | Stk. | — | 8 | 8½% | Derby Con. Stk. | 128—135 | .. | .. |
| 55,000 | " | — | 4 | 4% | Do. Deb. Stk. | 102—104 | .. | .. |
| 1,002,180 | 10 | July 29 | 10 | 5/0 | European, Ltd. | 17½—18 | 13½—14½ | 13½—14½ |
| 16,398,975 | Stk. | Feb. 10 | 4/17/4 | 80/- | Gas Light and Coke { 4 p.c. Ord. | 98—102 | 60—62 | 60—61 |
| 2,600,000 | " | " | 8½ | 26/8 | 3½ p.c. max. | 76—79 | 55—57 | 55½ |
| 4,062,285 | " | " | 4 | 4% | 4 p.c. Con. Pref. | 96—99 | 70—72 | 71 |
| 4,674,850 | " | June 11 | 8 | 8% | 3 p.c. Con. Deb. | 72½—74½ | 55—57* | 57½ |
| 180,000 | " | " | 10 | 10% | 10 p.c. Bonds | .. | .. | .. |
| 82,500 | " | Mar. 12 | 4 | 4½% | Hastings & St. L. 5 p.c. | .. | 59—64 | .. |
| 258,740 | " | — | 3½ | 2⅞% | Do. 3½ p.c | 37—39 | 44—49 | .. |
| 70,000 | 10 | April 30 | 11 | 7% | Hongkong & China, Ltd. | 16½—18½ | 7—8 | .. |
| 86,600 | Stk. | Sept. 12 | 9 | 8⅛% | Hornsey 7 p.c. | .. | 115—120 | .. |
| 181,000 | " | Mar. 12 | 7½ | 6⅜% | Ilford A and C. | 151—154 | 90—95 | .. |
| 65,780 | " | " | 6⅝ | 4⅝% | Do. B | 115—118 | 69—74 | .. |
| 65,500 | " | June 26 | 4 | 4% | Do. 4 p.c. Deb. | 92—94 | 62—65 | .. |
| 4,940,000 | " | May 14 | 9 | 4½% | Imperial Continental | 150—160 | 143—147 | 141—144 |
| 1,326,000 | " | Feb. 12 | 3½ | 3½% | Do. 3½ p.c. Deb. Red. | 84—86 | 73—75 | .. |
| 236,242 | " | Mar. 12 | 6¼ | 6¼% | Lea Bridge Ord. 5 p.c. | 119—121 | 90—95 | .. |
| 2,498,936 | " | Feb. 26 | 10 | 42/6 | Liverpool 5 p.c. Ord. { A | 211—213 | .. | .. |
| | | | | | { B | 146—148 | | .. |
| 806,068 | " | June 26 | 4 | 4% | Do. 4 p.c. Pr. Deb. Stk. | .. | .. | .. |
| 165,736 | " | Feb. 17 | 7/5/6 | 32/- | Maidstone 5 p.c. | .. | 58—63 | .. |
| 75,000 | 5 | June 11 | 6 | 3 % | Malta & Mediterranean | 4½—4⅝ | 3⅜—3½ | .. |
| 250,000 | 100 | April 1 | 4½ | 4½% | Met. of Melbourne { 4½ p.c. Deb. | 99—101 | 90—97 | 94½ |
| 541,220 | 20 | May 19 | 4 | 5% | Monte Video, Ltd. | 11½—12 | 13—14 | .. |
| 1,878,822 | Stk. | July 29 | 4½ | 3½% | Newcastle&Gateh'd Con. | 98½—99½ | 67—69 | .. |
| 529,798 | " | June 26 | 3½ | 3½% | Do. 3½ p.c. Deb. | 82—88 | 57—59 | .. |
| 15,000 | 10 | Mar. 18 | — | 11⅛% | North Middlesex 10 p.c. | .. | 13½—14 | .. |
| 55,940 | 10 | " | 7/14/0 | 7⅛% | " " 7 p.c. | 14—15 | 9½—9⅞ | .. |
| 300,000 | Stk. | May 14 | 8 | 8% | Oriental, Lad. | 117—122 | 101—104 | .. |
| 60,000 | 5 | Mar. 26 | 10 | 1/- | Ottoman, Ltd. | 7½—7⅝ | 4⅜—5½ | .. |
| 60,000 | 50 | Feb. 26 | 13 | 7½% | Portsea, Island B | 128—131 | 76—81 | .. |
| 100,000 | 50 | " | 12 | 6⅜% | Do. C | 118—121 | 68—69 | .. |
| 249,980 | 5 | April 29 | 8 | — | Primitiva Ord. | 5½—6 | 1⅜—2⅜ | 35/—40/- |
| 499,960 | 5 | June 26 | 5 | — | Do. 5 p.c. Pref. | 4—5 | 3½—3⅝ | 66 3—70/- |
| 551,600 | 100 | June 9 | 4 | 4% | Do. 4 p.c. Deb. | 91—93 | 71—73 | .. |
| 600,000 | Stk. | July 31 | 4 | 4% | Do. " " 1911 | .. | 50—53 | .. |
| 846,198 | " | June 26 | 4 | 4% | River Plate 4 p.c. Deb. | 85—87 | 50—53 | .. |
| 150,000 | 10 | May 14 | 5 | 6% | San Paulo { 6 p.c. Pref. | 10½—11 | 7½—8 | .. |
| 125,000 | 50 | July 1 | 5 | 5% | { 5 p.c. Deb. | 44—49 | 41—43 | .. |
| 136,000 | Stk. | Mar. 12 | 10 | 6% | Sheffield A | 233—234 | 80—84 | .. |
| 209,984 | " | " | 10 | 5% | Do. B | 232—234 | 80—84 | .. |
| 528,500 | " | " | 10 | 4⅜% | Do. C | 230—232 | 71—74 | .. |
| 133,201 | Stk. | Sept. 12 | 4 | 4% | Shrewsbury 5 p.c. | .. | .. | .. |
| 90,000 | 10 | May 28 | 9 | 10% | South African. | 10½—11½ | 13—14 | 13 5/16 |
| 6,609,896 | Stk. | Feb. 10 | 5/4/0 | 80/- | South Met. 4 p.c. Ord. | 11½—11⅝ | 61—63 | 61—61½ |
| 250,000 | " | July 12 | — | 5% | Do. Pref. | .. | 96—98 | .. |
| 1,895,445 | " | July 10 | 8 | 8% | Do. 3 p.c. Deb. | 73½—74½ | 54—56 | .. |
| 224,920 | " | Feb. 26 | 8½ | 5⅝% | South Shields Con. Stk. | 154—159 | 99—101 | .. |
| 952,726 | " | " | 6 | 3¾% | S'th Suburb'n Ord. 5 p.c. | 114—116 | 76—79 | 78—78½ |
| 197,553 | Stk. | June 26 | 5 | 5% | Do. 5 p.c. Deb. Stk. | 116—118 | 89—93 | .. |
| 647,740 | " | May 14 | 7½ | 5% | Southampton Ord. | 99—102 | 67—69 | 67⅞ |
| 121,375 | " | Dec. 30 | 4 | 4% | Do. 4 p.c. Deb. Stk. | .. | 64—66 | .. |
| 120,000 | " | Feb. 12 | — | 4⅛% | Tottenham District { A 5 p.c. | 135—138 | 90—95 | .. |
| 752,375 | " | " | 6 | 3% | { B 3½ p.c. | 115—117 | 82—87 | .. |
| 181,355 | " | June 26 | 4 | 4% | { 4 p.c. Deb. | 87—89 | 64—65* | .. |
| 122,380 | 10 | Dec. 30 | 5 | — | Tuscan, Ltd. | 5—6 | 1—2 | .. |
| 149,900 | 10 | July 1 | 5 | 5% | Do. 5 p.c. Deb. Red. | 93—95 | 45—50 | .. |
| 336,476 | Stk. | Mar. 12 | 5 | 5% | Tynemouth 5 p.c. max. | 108½—109 | 83—85 | .. |
| 80,000 | " | Feb. 26 | 8⅜ | 55/- | Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c. | 151—156 | 88—93 | .. |
| 255,896 | " | " | 6¾ | 40/- | Do. B 3½ p.c. | 129—134 | 68—73 | .. |
| 103,075 | " | " | — | 38/6 | Do. C | .. | 68—73 | .. |
| 140,865 | " | " | — | 38/6 | New Ordinary | .. | 68—73 | .. |
| 269,000 | " | " | 6½ | 38/ 9 | Wimbledon 5 p.c. | 117—122 | 64—73 | .. |
| 98,000 | " | " | 6¾ | 40/- | Epsom 5 p.c. | 121—126 | 70—75 | 71½ |
| 88,416 | " | June 26 | 3 | 3% | 3 p.c. Deb. Stk. | 86—89 | 50—52 | .. |

* Ex Div. † Ex Arrears.

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